

SEQUENCE LISTING

<110> Genencor International, Inc.
Weyler, Walter
Hsu, Amy Kuang-Hua

<120> pckA Modifications and Enhanced Protein Expression in Bacillus

<130> GC836-PCT

<140> PCT/US2005/011821

<141> 2005-04-07

<150> US 60/561,110

<151> 2004-04-09

<160> 205

<170> PatentIn version 3.2

<210> 1

<211> 129

<212> DNA

<213> Bacillus subtilis

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ctatggggg 129

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<211> 43

<212> PRT

<213> Bacillus subtilis

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Ile Gly Ala Ala Cys Leu Val Asp Gly Pro Ile Pro Asp Phe Glu Ile
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Ala Gly Ala Thr Gly Leu Phe Gly Leu Trp Gly
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<211> 456

<212> DNA

<213> Bacillus subtilis

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aatccgctcg ttcaattttt aaaaaaagtt tctgccacac tggaagtgtga attaacagaa 180
ttatttgacg cagaacaat gatgtatgaa aaaaatcagcg gcggtaagaaga agaattggcg 240
gtacatttag tgcaagccgt acaagccggg atggaaaagg aagaattgtt cacttttacg 300
aacagactca agaaagaaca gcctgaaact gcctcttacc gcaaccgcaa actgacggaa 360
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catgaagtca aatccttttt aaaaaaaa ggaaga 456

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 <213> *Bacillus subtilis*

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 20 25 30
 Lys Ile Glu Arg Gly Val His Thr Asn Pro Ser Val Gln Phe Leu Lys
 35 40 45
 Lys Val Ser Ala Thr Leu Glu Val Glu Leu Thr Glu Leu Phe Asp Ala
 50 55 60
 Glu Thr Met Met Tyr Glu Lys Ile Ser Gly Gly Glu Glu Glu Trp Arg
 65 70 75 80
 Val His Leu Val Gln Ala Val Gln Ala Gly Met Glu Lys Glu Glu Leu
 85 90 95
 Phe Thr Phe Thr Asn Arg Leu Lys Lys Glu Gln Pro Glu Thr Ala Ser
 100 105 110
 Tyr Arg Asn Arg Lys Leu Thr Glu Ser Asn Ile Glu Glu Trp Lys Ala
 115 120 125
 Leu Met Ala Glu Ala Arg Glu Ile Gly Leu Ser Val His Glu Val Lys
 130 135 140
 Ser Phe Leu Lys Thr Lys Gly Arg
 145 150

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 <212> DNA
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 ggtacttcga ttgtgaaagc tgctggctgc atgggctgtt gggcctcgaa gagtattgct 120
 atgacacgtg tttgtgcact tccgcatacct gctatgagag ctatt 165

<210> 6
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 Met Lys Pro Gly Gly Thr Ser Ile Val Lys Ala Ala Gly Cys Met Gly
 20 25 30
 Cys Trp Ala Ser Lys Ser Ile Ala Met Thr Arg Val Cys Ala Leu Pro
 35 40 45
 His Pro Ala Met Arg Ala Ile
 50 55

<210> 7
 <211> 831
 <212> DNA
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ttccaccatgt tttttaccct gatgatgagc gaaacgggtt ttgcggcggg actgaataaaa 120
gatcaaaaagc gccggggcgga acagctgaca agtatctttg aaaacggcac aacggagatc 180
caatatggat atgtagagcg attggatgac gggcgaggct atacatcgcg acgggcaggc 240
tttacaaagg ctaccgggga tgcattggaa gtagtggaa ggcagttccg 300
aataacaaac tgaaaaagta tctgcctgaa ttgcgcgcgc tggccaaagg agaaagcgat 360
gatacaagca atctcaaggg attcgcttct gcctggaaagt cgcttgcaaa tgataaggaa 420
tttcgcgcgc ctcaagacaa agtaaatgac catttgtatt atcagctcg catgaaacga 480
tcggataaag ccggactaaa aacagcattg gcaagagctg tgatgtacga tacggttatt 540
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gacgtacgct atgacgatct gatgaatccg gccaatcatg acacccgta cgaatggaga 720
gaatcagttg cccgtgtgga cgtgcttcgc tctatcgcca aggagacaaa ctataatcta 780
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<212> PRT
<213> *Bacillus subtilis*

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35 40 45
Leu Thr Ser Ile Phe Glu Asn Gly Thr Thr Glu Ile Gln Tyr Gly Tyr
50 55 60
Val Glu Arg Leu Asp Asp Gly Arg Gly Tyr Thr Cys Gly Arg Ala Gly
65 70 75 80
Phe Thr Thr Ala Thr Gly Asp Ala Leu Glu Val Val Glu Val Tyr Thr
85 90 95
Lys Ala Val Pro Asn Asn Lys Leu Lys Lys Tyr Leu Pro Glu Leu Arg
100 105 110
Arg Leu Ala Lys Glu Glu Ser Asp Asp Thr Ser Asn Leu Lys Gly Phe
115 120 125
Ala Ser Ala Trp Lys Ser Leu Ala Asn Asp Lys Glu Phe Arg Ala Ala
130 135 140
Gln Asp Lys Val Asn Asp His Leu Tyr Tyr Gln Pro Ala Met Lys Arg
145 150 155 160
Ser Asp Asn Ala Gly Leu Lys Thr Ala Leu Ala Arg Ala Val Met Tyr
165 170 175
Asp Thr Val Ile Gln His Gly Asp Gly Asp Asp Pro Asp Ser Phe Tyr
180 185 190
Ala Leu Ile Lys Arg Thr Asn Lys Lys Ala Gly Gly Ser Pro Lys Asp
195 200 205
Gly Ile Asp Glu Lys Lys Trp Leu Asn Lys Phe Leu Asp Val Arg Tyr
210 215 220
Asp Asp Leu Met Asn Pro Ala Asn His Asp Thr Arg Asp Glu Trp Arg
225 230 235 240
Glu Ser Val Ala Arg Val Asp Val Leu Arg Ser Ile Ala Lys Glu Asn
245 250 255
Asn Tyr Asn Leu Asn Gly Pro Ile His Val Arg Ser Asn Glu Tyr Gly
260 265 270

Asn Phe Val Ile Lys
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<210> 9
<211> 792
<212> DNA
<213> *Bacillus subtilis*

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acaaatctcg ttgacatgct tgcgaaaaaa tactcaaaag gcaaaagctt ccacgaggat 180
ctccgcccag ttggcatgat cgggctgcta ggcgcgatta agcgatacga tccgtgtgtc 240
ggcaaatcgt ttgaagcttt tgcaatcccg acaatcatcg gtgaaattaa acgtttcctc 300
agagataaaa catggagcgt tcatgtgccc agacgaatta aagaactcgg tccaagaatc 360
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ggcgaattcc tcatgttttc tgaagaagag gttcttgaaa cgatggaaat ggcaaaaagc 480
tatcaagcct tatccgttga ccacagcatt gaagcggatt cggacggagg cactgtccag 540
attcttgata tcgtcggatc acaggaggac ggatatgagc gggtaacaca gcaattgatg 600
ctgcaaaagc tgcttcatgt cctttcagac cgtgagaaac aaatcataga ccttacgtat 660
attcaaaaca aaagccaaaa agaaactggg gacattctcg gtatatctca aatgcacgtc 720
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<210> 10
<211> 264
<212> PRT
<213> *Bacillus subtilis*

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Gln Glu Thr Leu Val Arg Val Tyr Thr Asn Leu Val Asp Met Leu Ala
35     40     45
Lys Lys Tyr Ser Lys Gly Lys Ser Phe His Glu Asp Leu Arg Gln Val
50     55     60
Gly Met Ile Gly Leu Leu Gly Ala Ile Lys Arg Tyr Asp Pro Val Val
65     70     75     80
Gly Lys Ser Phe Glu Ala Phe Ala Ile Pro Thr Ile Ile Gly Glu Ile
85     90     95
Lys Arg Phe Leu Arg Asp Lys Thr Trp Ser Val His Val Pro Arg Arg
100    105    110
Ile Lys Glu Leu Gly Pro Arg Ile Lys Met Ala Val Asp Gln Leu Thr
115    120    125
Thr Glu Thr Gln Arg Ser Pro Lys Val Glu Glu Ile Ala Glu Phe Leu
130    135    140
Asp Val Ser Glu Glu Glu Val Leu Glu Thr Met Glu Met Gly Lys Ser
145    150    155    160
Tyr Gln Ala Leu Ser Val Asp His Ser Ile Glu Ala Asp Ser Asp Gly
165    170    175
Ser Thr Val Thr Ile Leu Asp Ile Val Gly Ser Gln Glu Asp Gly Tyr
180    185    190
Glu Arg Val Asn Gln Gln Leu Met Leu Gln Ser Val Leu His Val Leu
195    200    205
Ser Asp Arg Glu Lys Gln Ile Ile Asp Leu Thr Tyr Ile Gln Asn Lys

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210 215 220
 Ser Gln Lys Glu Thr Gly Asp Ile Leu Gly Ile Ser Gln Met His Val
 225 230 235 240
 Ser Arg Leu Gln Arg Lys Ala Val Lys Lys Leu Arg Glu Ala Leu Ile
 245 250 255
 Glu Asp Pro Ser Met Glu Leu Met
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<210> 11
 <211> 744
 <212> DNA
 <213> *Bacillus subtilis*

<400> 11
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 tgggtatttgc tgtttgtctt gggcgctatg gtatactgga catatgagcc cacttcccta 180
 tttaccaccat gggaacggta tctcattgtc gcagtcagtt ttgctttgat tgaatgctttt 240
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 gaaattcttg aagaaaaaca cgaaatgctc cacatgtatc tcaatcggtt gaaaaacatac 360
 caatacctat tgaaaaacga accgatccat gtttattatg gaagtataga tgcattatgct 420
 gaaggtattg ataagtgctt gaaaacctat gctgataaaa tgaacttaac ggcttctctt 480
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 ctcatccctt ttaccatcga gacacagaac tatgtcatca agctgacgct tgacagcatt 660
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<210> 12
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 <212> PRT
 <213> *Bacillus subtilis*

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 Lys Met Ser Ala Ile Arg Lys Thr Trp Tyr Leu Leu Phe Val Leu Gly
 35 40 45
 Ala Met Val Tyr Trp Thr Tyr Glu Pro Thr Ser Leu Phe Thr His Trp
 50 55 60
 Glu Arg Tyr Leu Ile Val Ala Val Ser Phe Ala Leu Ile Asp Ala Phe
 65 70 75 80
 Ile Phe Leu Ser Ala Tyr Val Lys Lys Leu Ala Gly Ser Glu Leu Glu
 85 90 95
 Thr Asp Thr Arg Glu Ile Leu Glu Glu Asn Asn Glu Met Leu His Met
 100 105 110
 Tyr Leu Asn Arg Leu Lys Thr Tyr Gln Tyr Leu Leu Lys Asn Glu Pro
 115 120 125
 Ile His Val Tyr Tyr Gly Ser Ile Asp Ala Tyr Ala Glu Gly Ile Asp
 130 135 140
 Lys Leu Leu Lys Thr Tyr Ala Asp Lys Met Asn Leu Thr Ala Ser Leu
 145 150 155 160
 Cys His Tyr Ser Thr Gln Ala Asp Lys Asp Arg Leu Thr Glu His Met
 165 170 175
 Asp Asp Pro Ala Asp Val Gln Thr Arg Leu Asp Arg Lys Asp Val Tyr

180 185 190
 Tyr Asp Gln Tyr Gly Lys Val Val Leu Ile Pro Phe Thr Ile Glu Thr
 195 200 205
 Gln Asn Tyr Val Ile Lys Leu Thr Ser Asp Ser Ile Val Thr Glu Phe
 210 215 220
 Asp Tyr Leu Leu Phe Thr Ser Leu Thr Ser Ile Tyr Asp Leu Val Leu
 225 230 235 240
 Pro Ile Glu Glu Glu Gly Glu Gly
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<210> 13
 <211> 120
 <212> DNA
 <213> *Bacillus subtilis*

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<210> 14
 <211> 40
 <212> PRT
 <213> *Bacillus subtilis*

<400> 14
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 Ile Phe Thr Ala Ala Gly Val Ser Ala Asn Ala Glu Ala Leu Asp Phe
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 His Val Thr Glu Arg Gly Met Thr
 35 40

<210> 15
 <211> 1134
 <212> DNA
 <213> *Bacillus subtilis*

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 gaaattgagg atatggaaga agaccaagat ttgctgctgt attattcttt aatggagttc 180
 aggcaccgtg tcatgtctga ttacattaaag ccttttggag aggacacgtc gcagctagag 240
 ttttcagaat gtttagaaga catcgaaggg aatcagtaaca agctgacagg gcttctcgaa 300
 tattacttta atttttttcg aggaatgtat gaatttaagc agaagatggt tgcagtgcc 360
 atgatgtatt ataaaacgggc agaaaagaat cttgccctcg tctcggtatga tattgagaaa 420
 gcagagtttg cttttaaaat ggctgagatt ttttacaatt taaaacaaac ctatgtttcg 480
 atgagctacg ccgttcaggc attagaaaac taccaaaatg atgaaacgta caccgtccgc 540
 agaatccaat gtgaattcgt tattgcaggt aattatgatg atatgcagta tccagaaaaga 600
 gcattgcccc acttagaact ggcttttagat cttgcaaaaga aagaaggcaa tccccgcctg 660
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 caaaaaaagt atcgtgaagg attggaatc gcccgtaaat acagtgatga attatttgtg 900
 gagctttttc aattttttaca tgcgtttatac ggaaaaaaca ttgacacaga atcagttctc 960
 cacacatttc aattttctga agaacatatg ctgtatcctt atattgaaga gctggcgcat 1020
 gatgctgccc aattctatat agaaaacgga cagcccgaaa aagcactttc attttatgag 1080
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<210> 16
 <211> 378
 <212> PRT
 <213> *Bacillus subtilis*

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 35 40 45
 Gln Asp Leu Leu Leu Tyr Tyr Ser Leu Met Glu Phe Arg His Arg Val
 50 55 60
 Met Leu Asp Tyr Ile Lys Pro Phe Gly Glu Asp Thr Ser Gln Leu Glu
 65 70 75 80
 Phe Ser Glu Leu Leu Glu Asp Ile Glu Gly Asn Gln Tyr Lys Leu Thr
 85 90 95
 Gly Leu Leu Glu Tyr Tyr Phe Asn Phe Phe Arg Gly Met Tyr Glu Phe
 100 105 110
 Lys Gln Lys Met Phe Val Ser Ala Met Met Tyr Tyr Lys Arg Ala Glu
 115 120 125
 Lys Asn Leu Ala Leu Val Ser Asp Asp Ile Glu Lys Ala Glu Phe Ala
 130 135 140
 Phe Lys Met Ala Glu Ile Phe Tyr Asn Leu Lys Gln Thr Tyr Val Ser
 145 150 155 160
 Met Ser Tyr Ala Val Gln Ala Leu Glu Thr Tyr Gln Met Tyr Glu Thr
 165 170 175
 Tyr Thr Val Arg Arg Ile Gln Cys Glu Phe Val Ile Ala Gly Asn Tyr
 180 185 190
 Asp Asp Met Gln Tyr Pro Glu Arg Ala Leu Pro His Leu Glu Leu Ala
 195 200 205
 Leu Asp Leu Ala Lys Lys Glu Gly Asn Pro Arg Leu Ile Ser Ser Ala
 210 215 220
 Leu Tyr Asn Leu Gly Asn Cys Tyr Glu Lys Met Gly Glu Leu Gln Lys
 225 230 235 240
 Ala Ala Glu Tyr Phe Gly Lys Ser Val Ser Ile Cys Lys Ser Glu Lys
 245 250 255
 Phe Asp Asn Leu Pro His Ser Ile Tyr Ser Leu Thr Gln Val Leu Tyr
 260 265 270
 Lys Gln Lys Asn Asp Ala Glu Ala Gln Lys Lys Tyr Arg Glu Gly Leu
 275 280 285
 Glu Ile Ala Arg Gln Tyr Ser Asp Glu Leu Phe Val Glu Leu Phe Gln
 290 295 300
 Phe Leu His Ala Leu Tyr Gly Lys Asn Ile Asp Thr Glu Ser Val Ser
 305 310 315 320
 His Thr Phe Gln Phe Leu Glu Glu His Met Leu Tyr Pro Tyr Ile Glu
 325 330 335
 Glu Leu Ala His Asp Ala Ala Gln Phe Tyr Ile Glu Asn Gly Gln Pro
 340 345 350
 Glu Lys Ala Leu Ser Phe Tyr Glu Lys Met Val His Ala Gln Lys Gln
 355 360 365
 Ile Gln Arg Gly Asp Cys Leu Tyr Glu Ile
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<210> 17

<211> 1353
 <212> DNA
 <213> *Bacillus subtilis*

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 acgtatacga cgattgaaaa tgagcagcat gttctgacag agtaccgcct gccaggttcg 180
 attgaaagcg gctattacag cgaggaagcg acggcgccga caactgtccg ctccgtacag 240
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 tottcattta tccacaaggt gtacaagctg gctgataaag aggaagctaa aaagaacagt 360
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 aatggacaat cagcgatgat gctctcttac gcgcttgatt cttatcgagg cgatttgccc 480
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 ccggctattt ggcttgcaaa gtatttatca aggcctcttg tatcatttga aaaacacgtc 600
 aaacggattt ctgaacagga ttgggatgac ccagtaaaag tggaccggaa agatgaaatc 660
 ggcaaatgtg gccataccat cgaagagatg cgccaaaagc ttgtgcaaaa ggatgaaaca 720
 gaaagaactc tattgcaaaa tatctctcat gatttaaaaa cgccgggtcat ggatcatcaga 780
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<210> 18
 <211> 450
 <212> PRT
 <213> *Bacillus subtilis*

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 20 25 30
 Leu Arg Asp Phe Phe Thr Asn Glu Thr Tyr Thr Thr Ile Glu Asn Glu
 35 40 45
 Gln His Val Leu Thr Glu Tyr Arg Leu Pro Gly Ser Ile Glu Arg Arg
 50 55 60
 Tyr Tyr Ser Glu Glu Ala Thr Ala Pro Thr Thr Val Arg Ser Val Gln
 65 70 75 80
 His Val Leu Leu Pro Glu Asn Glu Glu Ala Ser Ser Asp Lys Asp Leu
 85 90 95
 Ser Ile Leu Ser Ser Ser Phe Ile His Lys Val Tyr Lys Leu Ala Asp
 100 105 110
 Lys Gln Glu Ala Lys Lys Lys Arg Tyr Ser Ala Asp Val Asn Gly Glu
 115 120 125
 Lys Val Phe Phe Val Ile Lys Lys Gly Leu Ser Val Asn Gly Gln Ser
 130 135 140
 Ala Met Met Leu Ser Tyr Ala Leu Asp Ser Tyr Arg Asp Asp Leu Ala
 145 150 155 160
 Tyr Thr Leu Phe Lys Gln Leu Leu Phe Ile Ile Ala Val Val Ile Leu
 165 170 175

Leu Ser Trp Ile Pro Ala Ile Trp Leu Ala Lys Tyr Leu Ser Arg Pro
 180 185 190
 Leu Val Ser Phe Glu Lys His Val Lys Arg Ile Ser Glu Gln Asp Trp
 195 200 205
 Asp Asp Pro Val Lys Val Asp Arg Lys Asp Glu Ile Gly Lys Leu Gly
 210 215 220
 His Thr Ile Glu Glu Met Arg Gln Lys Leu Val Gln Lys Asp Glu Thr
 225 230 235 240
 Glu Arg Thr Leu Leu Gln Asn Ile Ser His Asp Leu Lys Thr Pro Val
 245 250 255
 Met Val Ile Arg Gly Tyr Thr Gln Ser Ile Lys Asp Gly Ile Phe Pro
 260 265 270
 Lys Gly Asp Leu Glu Asn Thr Val Asp Val Ile Glu Cys Glu Ala Leu
 275 280 285
 Lys Leu Glu Lys Lys Ile Lys Asp Leu Leu Tyr Leu Thr Lys Leu Asp
 290 295 300
 Tyr Leu Ala Lys Gln Lys Val Gln His Asp Met Phe Ser Ile Val Glu
 305 310 315 320
 Val Thr Glu Glu Val Ile Glu Arg Leu Lys Trp Ala Arg Lys Glu Leu
 325 330 335
 Ser Trp Glu Ile Val Glu Glu Asp Ile Leu Met Pro Gly Asp Pro Glu
 340 345 350
 Gln Trp Asn Lys Leu Leu Glu Asn Ile Leu Glu Asn Gln Ile Arg Tyr
 355 360 365
 Ala Glu Thr Lys Ile Glu Ile Ser Met Lys Gln Asp Asp Arg Asn Ile
 370 375 380
 Val Ile Thr Ile Lys Asn Asp Gly Pro His Ile Glu Asp Glu Met Leu
 385 390 395 400
 Ser Ser Leu Tyr Glu Pro Phe Asn Lys Gly Lys Lys Gly Glu Phe Gly
 405 410 415
 Ile Gly Leu Ser Ile Val Lys Arg Ile Leu Thr Leu His Lys Ala Ser
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 435 440 445
 Pro Lys
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<210> 19
 <211> 2013
 <212> DNA
 <213> *Bacillus subtilis*

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 aacctgccc aaagccacga gcattttgtc agtgcattgc acggagagta tcaggcattc 240
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 gaccatctgc atgtggtcgg cgatatattat gcacgcggcc cgcagccgga tagaattatg 720
 gaagaactga tcaactatca ttctgtcgat attcagtggt gaaatcacga tgcctttgg 780
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ctggccgaaa	aattattatga	tgataatcca	gcgttccgtc	caaaagcaga	cgaaaacagg	960
ccagaggatg	agattaaagca	aatcacaaaa	atccatcaag	cgattgccat	gatccaattc	1020
aagcttgaga	gcccgattat	caagagacgg	cpgaacttta	atatggaaga	gcggctgtta	1080
ttagagaaaa	tagactatga	caaaaaatgaa	atcacgctga	acggaaaaac	atatcaactg	1140
gaaaacacct	gctttgcgac	gattaatccg	gagcagccag	atcagctatt	agaagaagaa	1200
gcagaagtca	tagacaagct	gctattctct	gtccagcatt	ccgaaaagct	gggcccgcatt	1260
atgaatttta	tgatgaaaaa	aggcagcctt	tattttaaatt	ataacgcgaa	cctgttgatt	1320
cacggctgtg	ttccagttga	tgaaaacggc	aatatggaaa	cgatgatgat	tgaggataaa	1380
ccgtatgcgg	gccgtgagct	gctcgatgta	tttgaacgat	tcttgccgga	agcctttgcc	1440
caccgggaag	aaaccgatga	cctggcgaca	gatattggct	ggtatttatg	gacaggcgaa	1500
tactctctcc	tcttcggaaa	acgcgccatg	acgacatttg	agcgtatttt	catcaaaagag	1560
aaggaaaacg	ataaagagaa	gaaaaaccgc	tatttattatt	tacgagaaga	cgaggccaacc	1620
tgccgaaaca	tccctggcaga	attcggcctc	aatccagatc	acggccatatt	catcaacggc	1680
catacacctg	taaaagaagt	cgaaggagaa	gacccaatca	aagcaaacgg	aaaaatgatc	1740
gtcatcgacg	cgcgcttctc	caaagcctac	caatccacaa	caggcctcgc	cggtacacgc	1800
ctgctatata	actcctacgg	catgcagctc	gtcgcccata	aacacttcaa	ttccaaggca	1860
gaagtctctaa	gcaccggaac	cgacgtctta	acggtcaaac	gattagtggg	caaagagctt	1920
gagcggaaga	aagtgaagga	aacgaatgtg	ggtgaggaat	tgttgcagga	agttgcgatt	1980
ttagagagtt	tgccgggagta	tcggtatatg	aag			2013

<210> 20
 <211> 671
 <212> PRF
 <213> *Bacillus subtilis*

<400> 20
 Met Phe Lys Asn Asn Val Ile Leu Leu Asn Ser Pro Tyr His Ala His
 1 5 10 15
 Ala His Lys Glu Gly Phe Ile Leu Lys Arg Gly Trp Thr Val Leu Glu
 20 25 30
 Ser Lys Tyr Leu Asp Leu Leu Ala Gln Lys Tyr Asp Cys Glu Glu Lys
 35 40 45
 Val Val Thr Glu Ile Ile Asn Leu Lys Ala Ile Leu Asn Leu Pro Lys
 50 55 60
 Gly Thr Glu His Phe Val Ser Asp Leu His Gly Glu Tyr Gln Ala Phe
 65 70 75 80
 Gln His Val Leu Arg Asn Gly Ser Gly Arg Val Lys Glu Lys Ile Arg
 85 90 95
 Asp Ile Phe Ser Gly Val Ile Tyr Asp Arg Glu Ile Asp Glu Leu Ala
 100 105 110
 Ala Leu Val Tyr Tyr Pro Glu Asp Lys Leu Lys Leu Ile Lys His Asp
 115 120 125
 Phe Asp Ala Lys Glu Ala Leu Asn Glu Trp Tyr Lys Glu Thr Ile His
 130 135 140
 Arg Met Ile Lys Leu Val Ser Tyr Cys Ser Ser Lys Tyr Thr Arg Ser
 145 150 155 160
 Lys Leu Arg Lys Ala Leu Pro Ala Gln Phe Ala Tyr Ile Thr Glu Glu
 165 170 175
 Leu Leu Tyr Lys Thr Glu Gln Ala Gly Asn Lys Glu Gln Tyr Tyr Ser
 180 185 190
 Glu Ile Ile Asp Gln Ile Ile Glu Leu Gly Gln Ala Asp Lys Leu Ile
 195 200 205
 Thr Gly Leu Ala Tyr Ser Val Gln Arg Leu Val Val Asp His Leu His
 210 215 220
 Val Val Gly Asp Ile Tyr Asp Arg Gly Pro Gln Pro Asp Arg Ile Met
 225 230 235 240

Glu Glu Leu Ile Asn Tyr His Ser Val Asp Ile Gln Trp Gly Asn His
 245 250 255
 Asp Val Leu Trp Ile Gly Ala Tyr Ser Gly Ser Lys Val Cys Leu Ala
 260 265 270
 Asn Ile Ile Arg Ile Cys Ala Arg Tyr Asp Asn Leu Asp Ile Ile Glu
 275 280 285
 Asp Val Tyr Gly Ile Asn Leu Arg Pro Leu Leu Asn Leu Ala Glu Lys
 290 295 300
 Tyr Tyr Asp Asp Asn Pro Ala Phe Arg Pro Lys Ala Asp Glu Asn Arg
 305 310 315 320
 Pro Glu Asp Glu Ile Lys Gln Ile Thr Lys Ile His Gln Ala Ile Ala
 325 330 335
 Met Ile Gln Phe Lys Leu Glu Ser Pro Ile Ile Lys Arg Arg Pro Asn
 340 345 350
 Phe Asn Met Glu Glu Arg Leu Leu Glu Lys Ile Asp Tyr Asp Lys
 355 360 365
 Asn Glu Ile Thr Leu Asn Gly Lys Thr Tyr Gln Leu Glu Asn Thr Cys
 370 375 380
 Phe Ala Thr Ile Asn Pro Glu Gln Pro Asp Gln Leu Leu Glu Glu Glu
 385 390 395 400
 Ala Glu Val Ile Asp Lys Leu Leu Phe Ser Val Gln His Ser Glu Lys
 405 410 415
 Leu Gly Arg His Met Asn Phe Met Met Lys Lys Gly Ser Leu Tyr Leu
 420 425 430
 Lys Tyr Asn Gly Asn Leu Leu Ile His Gly Cys Ile Pro Val Asp Glu
 435 440 445
 Asn Gly Asn Met Glu Thr Met Met Ile Glu Asp Lys Pro Tyr Ala Gly
 450 455 460
 Arg Glu Leu Leu Asp Val Phe Glu Arg Phe Leu Arg Glu Ala Phe Ala
 465 470 475 480
 His Pro Glu Glu Thr Asp Asp Leu Ala Thr Asp Met Ala Trp Tyr Leu
 485 490 495
 Trp Thr Gly Glu Tyr Ser Ser Leu Phe Gly Lys Arg Ala Met Thr Thr
 500 505 510
 Phe Glu Arg Tyr Phe Ile Lys Glu Lys Glu Thr His Lys Glu Lys Lys
 515 520 525
 Asn Pro Tyr Tyr Tyr Leu Arg Glu Asp Glu Ala Thr Cys Arg Asn Ile
 530 535 540
 Leu Ala Glu Phe Gly Leu Asn Pro Asp His Gly His Ile Ile Asn Gly
 545 550 555 560
 His Thr Pro Val Lys Glu Ile Glu Gly Glu Asp Pro Ile Lys Ala Asn
 565 570 575
 Gly Lys Met Ile Val Ile Asp Gly Gly Phe Ser Lys Ala Tyr Gln Ser
 580 585 590
 Thr Thr Gly Ile Ala Gly Tyr Thr Leu Leu Tyr Asn Ser Tyr Gly Met
 595 600 605
 Gln Leu Val Ala His Lys His Phe Asn Ser Lys Ala Glu Val Leu Ser
 610 615 620
 Thr Gly Thr Asp Val Leu Thr Val Lys Arg Leu Val Asp Lys Glu Leu
 625 630 635 640
 Glu Arg Lys Lys Val Lys Glu Thr Asn Val Gly Glu Glu Leu Leu Gln
 645 650 655
 Glu Val Ala Ile Leu Glu Ser Leu Arg Glu Tyr Arg Tyr Met Lys
 660 665 670

<210> 21
 <211> 765

<212> DNA
<213> *Bacillus subtilis*

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<400> 21
atgaaacgag aaagcaacat tcaagtgtct agccgtggct aaaaagatca gctgtgagc 60
cagatttate aagtatcaac aatgacttct ctattagacg gagtatatga cggagatttt 120
gaactgtcag agattccgaa atatggagac ttccggtatcg gaacctttaa caagcttgac 180
ggagagctga ttgggtttga cggcgaaatt taccgtcttc gctcagacgg aaccgcgaca 240
ccggtccaaa atggagacgg ttccacggtt tgttcattta cgttctttac accggacatg 300
acgcaaaaaa ttgatcgcaa aatgacacgc gaagactttg aaaaagagat caacgacatg 360
ctgccaagca gaaacttatt ttatgcaatt cgcattgacg gattgtttaa aaaggtgcag 420
acaagaacag tagaacttca agaaaaacct tacgtgccaa tggttgaagc ggtcaaaaaca 480
cagccgattt tcaacttcga caacgtgaga ggaacgattg taggtttctt gacaccagct 540
tatgcaaacg gaatcgccgt ttctggctat caccctgcact tcattgacga aggcagcaat 600
tcaggcgagc acgtttttga ctatgtgtgt gaggatttga cgtttacgat ttctcaaaaa 660
atgaacatga atctcagact tccgaacaca gcggatttct ttaatgcgaa tctggataac 720
cctgattttg cgaagatatat cgaacaacct gaaggaagcc ctgaa 765

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<210> 22
<211> 255
<212> PRT
<213> *Bacillus subtilis*

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<400> 22
Met Lys Arg Glu Ser Asn Ile Gln Val Leu Ser Arg Gly Gln Lys Asp
1      5      10      15
Gln Pro Val Ser Gln Ile Tyr Gln Val Ser Thr Met Thr Ser Leu Leu
20     25     30
Asp Gly Val Tyr Asp Gly Asp Phe Glu Leu Ser Glu Ile Pro Lys Tyr
35     40     45
Gly Asp Phe Gly Ile Gly Thr Phe Asn Lys Leu Asp Gly Glu Leu Ile
50     55     60
Gly Phe Asp Gly Glu Phe Tyr Arg Leu Arg Ser Asp Gly Thr Ala Thr
65     70     75     80
Pro Val Gln Asn Gly Asp Arg Ser Pro Phe Cys Ser Phe Thr Phe Phe
85     90     95
Thr Pro Asp Met Thr His Lys Ile Asp Ala Lys Met Thr Arg Glu Asp
100    105    110
Phe Glu Lys Glu Ile Asn Ser Met Leu Pro Ser Arg Asn Leu Phe Tyr
115    120    125
Ala Ile Arg Ile Asp Gly Leu Phe Lys Lys Val Gln Thr Arg Thr Val
130    135    140
Glu Leu Gln Glu Lys Pro Tyr Val Pro Met Val Glu Ala Val Lys Thr
145    150    155    160
Gln Pro Ile Phe Asn Phe Asp Asn Val Arg Gly Thr Ile Val Gly Phe
165    170    175
Leu Thr Pro Ala Tyr Ala Asn Gly Ile Ala Val Ser Gly Tyr His Leu
180    185    190
His Phe Ile Asp Glu Gly Arg Asn Ser Gly Gly His Val Phe Asp Tyr
195    200    205
Val Leu Glu Asp Cys Thr Val Thr Ile Ser Gln Lys Met Asn Met Asn
210    215    220
Leu Arg Leu Pro Asn Thr Ala Asp Phe Phe Asn Ala Asn Leu Asp Asn
225    230    235    240
Pro Asp Phe Ala Lys Asp Ile Glu Thr Thr Gly Ser Pro Glu
245    250    255

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<210> 23
 <211> 1020
 <212> DNA
 <213> *Bacillus subtilis*

<400> 23
 atgaaggtaa aagtagcgat caacgggttt ggaagaatcg gaagaatggt ttttagaaaa 60
 gcgatgttag acgatcaaat tcaagttagt gccattaacg ccagctattc ccgagaaaagc 120
 ctggctcatt taataaagta tgacacaatt cacggcagat acgacaaaaga ggttgtggct 180
 ggtagaagata gcctgatcgt aaatggaaag aaagtgcctt tgttaaacag ccgtgatcca 240
 aaacagctgc ctgtggcgga atatgatatt gacatagtcg tcgaagcaac aggggaagttt 300
 aatgctaaag ataaagcgtat gggccatata gaagcaggtg caaaaaaagt gattttgacc 360
 gctccgggaa aaaatgaaga cgttaccatt gtgatggcg taaatgagga ccaattcgac 420
 gctgagcgcc atgtcattat ttcaaatgcg tcatgcacga caaattgcct tgcgcctgtt 480
 gtaaaagtgc tggatgaaga gtttggcatt gagagcggtc tgatgactac agttcatcg 540
 tatacgaatg accaaaaaaa tattgataac ccgcacaaag atttgcgcg ggcgcgggct 600
 tgcggtgaat ccatcattcc aacaacaaca ggagcggcaa agcgcgcttc gcttgtgctg 660
 ccgcattcga aaggaaaaact tcacggcctc gccttgcgtg tccctgttcc gaacgtctca 720
 ttggttgatc tcgttgttga tctgaaaacg gatgttacgg ctgaagaagt aaacgaggca 780
 ttttaacgag ctgccaaaac gtcgatgtac ggtgtacttg attactcaga tgaaccgctc 840
 gtttcgactg attataatac gaatccgcat tcagcgggtc ttgacgggct tacaacaatg 900
 gtaatggaag acaggaaagt aaaggtgctg gcgtggtatg acaacgaatg gggctactcc 960
 tgcagagttg ttgatctaatt ccgccatgta gcggcacgaa tgaacaatcc gtctgctgta 1020

<210> 24
 <211> 340
 <212> PRT
 <213> *Bacillus subtilis*

<400> 24
 Met Lys Val Lys Val Ala Ile Asn Gly Phe Gly Arg Ile Gly Arg Met
 1 5 10 15
 Val Phe Arg Lys Ala Met Leu Asp Asp Gln Ile Gln Val Val Ala Ile
 20 25 30
 Asn Ala Ser Tyr Ser Ala Glu Thr Leu Ala His Leu Ile Lys Tyr Asp
 35 40 45
 Thr Ile His Gly Arg Tyr Asp Lys Glu Val Val Ala Gly Glu Asp Ser
 50 55 60
 Leu Ile Val Asn Gly Lys Lys Val Leu Leu Asn Ser Arg Asp Pro
 65 70 75 80
 Lys Gln Leu Pro Trp Arg Glu Tyr Asp Ile Asp Ile Val Val Glu Ala
 85 90 95
 Thr Gly Lys Phe Asn Ala Lys Asp Lys Ala Met Gly His Ile Glu Ala
 100 105 110
 Gly Ala Lys Lys Val Ile Leu Thr Ala Pro Gly Lys Asn Glu Asp Val
 115 120 125
 Thr Ile Val Met Gly Val Asn Glu Asp Gln Phe Asp Ala Glu Arg His
 130 135 140
 Val Ile Ile Ser Asn Ala Ser Cys Thr Thr Asn Cys Leu Ala Pro Val
 145 150 155 160
 Val Lys Val Leu Asp Glu Glu Phe Gly Ile Glu Ser Gly Leu Met Thr
 165 170 175
 Thr Val His Ala Tyr Thr Asn Asp Gln Lys Asn Ile Asp Asn Pro His
 180 185 190
 Lys Asp Leu Arg Arg Ala Arg Ala Cys Gly Glu Ser Ile Ile Pro Thr
 195 200 205
 Thr Thr Gly Ala Ala Lys Ala Leu Ser Leu Val Leu Pro His Leu Lys

210		215		220	
Gly Lys Leu His Gly	Leu Ala Leu Arg Val	Pro Val Pro Asn Val Ser			
225	230	235	240		
Leu Val Asp Leu Val Val Asp	Leu Lys Thr Asp	Val Thr Ala Glu Glu			
	245	250	255		
Val Asn Glu Ala Phe Lys Arg Ala Ala Lys Thr	Ser Met Tyr Gly Val				
	260	265	270		
Leu Asp Tyr Ser Asp Glu Pro Leu Val Ser Thr	Asp Tyr Asn Thr Asn				
	275	280	285		
Pro His Ser Ala Val Ile Asp Gly Leu Thr Thr	Met Val Met Glu Asp				
	290	295	300		
Arg Lys Val Lys Val Leu Ala Trp Tyr Asp Asn Glu Trp Gly Tyr Ser					
	305	310	315	320	
Cys Arg Val Val Asp Leu Ile Arg His Val Ala Arg Met Lys His					
	325	330	335		
Pro Ser Ala Val					
	340				

<210> 25
 <211> 1176
 <212> DNA
 <213> *Bacillus subtilis*

<400> 25									
atgacgaagg	aatttgagtt	tttaaaagca	gagcttaata	gtatgaaaga	aaaccatata				60
tggaagaca	taaaacagct	tgaatctatg	caggggcccat	ctgtcacagt	gaatcaccaa				120
aaagtcatc	agctatcttc	taataattac	ctcggtattca	cttcacatcc	tagactcatc				180
aacgcgcga	aggaggccgt	tcaagcagtt	ggagccggca	ccggatcagt	gagaaacagt				240
gcgggtacat	ttacaatgca	tcaagagctt	gagaaaaagc	tgccagccct	taaaaaaacg				300
gaggcgccac	ttgtattcca	atcaggcttc	acaacaaacc	aaggcgctact	ttcaagtatt				360
ctatcaaaaag	aggacattgt	oatctcagat	gaattgaacc	atgcctctat	tattgacgga				420
attcgactga	caaaggcgga	taaaaagggtg	tatcagcacg	tcaatatgag	tgatttagag				480
cggggtgctga	gaaagtcagt	gaattatcgg	atgcgtctga	ttgtgacaga	cgcggtattt				540
tccatggatg	gaaacataga	tcctctgcct	gatattgtag	agctcgctga	gaaatatgac				600
gcattttgtga	tggtggatga	cgcccatgca	tccggagtag	ttggcgaaaa	cggcagggga				660
acggtgaatc	acttcggtct	tgacggcgaga	gtgcatattc	aggtcggaac	attaagcaag				720
gcaatcgagg	tgctcgggcg	ctacgctgca	ggttcaaaag	tgctgatgca	ttatttgcgc				780
cataaaggcc	gtccattttt	attcagcaca	tctcatcccg	cggcagtcac	tcgacgttgt				840
atggaagcga	ttgatgtctt	gcttgaagag	ccggagcata	tgagcgctt	gtgggagagt				900
actgcctatt	ttaaagcaat	gcttgtgaaa	atgggtctga	ctctcacgaa	gagtgaaaacg				960
ccgattcttc	ctattttta	agggtgatga	gggtgtggca	agcaattttc	agatcagctc				1020
ctttctcgcg	gtgttttttg	ccaaagtatc	gttttcccg	ctgtagcaaa	gggaaaagcc				1080
agaattcgca	cgattataac	agcagagcac	accaagatg	aactggatca	ggcgcttgat				1140
gtcatcgaaa	agacggcaaa	ggagctccag	ctattt						1176

<210> 26
 <211> 392
 <212> PRT
 <213> *Bacillus subtilis*

<400> 26									
Met Thr Lys Glu Phe Glu Phe Leu Lys Ala Glu Leu Asn Ser Met Lys									
1	5		10		15				
Glu Asn His Thr Trp Gln Asp Ile Lys Gln Leu Glu Ser Met Gln Gly									
	20		25		30				
Pro Ser Val Thr Val Asn His Gln Lys Val Ile Gln Leu Ser Ser Asn									
	35		40		45				

Asn Tyr Leu Gly Phe Thr Ser His Pro Arg Leu Ile Asn Ala Ala Gln
 50 55 60
 Glu Ala Val Gln Gln Tyr Gly Ala Gly Thr Gly Ser Val Arg Thr Ile
 65 70 75
 Ala Gly Thr Phe Thr Met His Gln Glu Leu Glu Lys Lys Leu Ala Ala
 85 90 95
 Phe Lys Lys Thr Glu Ala Ala Leu Val Phe Gln Ser Gly Phe Thr Thr
 100 105 110
 Asn Gln Gly Val Leu Ser Ser Ile Leu Ser Lys Glu Asp Ile Val Ile
 115 120 125
 Ser Asp Glu Leu Asn His Ala Ser Ile Ile Asp Gly Ile Arg Leu Thr
 130 135 140
 Lys Ala Asp Lys Lys Val Tyr Gln His Val Asn Met Ser Asp Leu Glu
 145 150 155
 Arg Val Leu Arg Lys Ser Met Asn Tyr Arg Met Arg Leu Ile Val Thr
 165 170 175
 Asp Gly Val Phe Ser Met Asp Gly Asn Ile Ala Pro Leu Pro Asp Ile
 180 185 190
 Val Glu Leu Ala Glu Lys Tyr Asp Ala Phe Val Met Val Asp Asp Ala
 195 200 205
 His Ala Ser Gly Val Leu Gly Glu Asn Gly Arg Gly Thr Val Asn His
 210 215 220
 Phe Gly Leu Asp Gly Arg Val His Ile Gln Val Gly Thr Leu Ser Lys
 225 230 235
 Ala Ile Gly Val Leu Gly Gly Tyr Ala Ala Gly Ser Lys Val Leu Ile
 245 250 255
 Asp Tyr Leu Arg His Lys Gly Arg Pro Phe Leu Phe Ser Thr Ser His
 260 265 270
 Pro Pro Ala Val Thr Ala Ala Cys Met Glu Ala Ile Asp Val Leu Leu
 275 280 285
 Glu Glu Pro Glu His Met Glu Arg Leu Trp Glu Asn Thr Ala Tyr Phe
 290 295 300
 Lys Ala Met Leu Val Lys Met Gly Leu Thr Leu Thr Lys Ser Glu Thr
 305 310 315
 Pro Ile Leu Pro Ile Leu Ile Gly Asp Glu Gly Val Ala Lys Gln Phe
 325 330 335
 Ser Asp Gln Leu Leu Ser Arg Gly Val Phe Ala Gln Ser Ile Val Phe
 340 345 350
 Pro Thr Val Ala Lys Gly Lys Ala Arg Ile Arg Thr Ile Ile Thr Ala
 355 360 365
 Glu His Thr Lys Asp Glu Leu Asp Gln Ala Leu Asp Val Ile Glu Lys
 370 375 380
 Thr Ala Lys Glu Leu Gln Leu Leu
 385 390

<210> 27
 <211> 1581
 <212> DNA
 <213> *Bacillus subtilis*

<400> 27
 atgaactcag ttgatttgac cgctgattta caagccttat taacatgtcc aaatgtgcgt 60
 cataatttat cagcagcaca gctaacagaa aaagtctctt cccgaaacga aggcatttta 120
 acatccacag gtgctgttgc cgcgacaaca ggcgcttaca caggacgctc acctaaagat 180
 aaattcatcg tggaggaaga aagcagcagaa aataagatcg attggggccc ggtgaatcag 240
 ccgatttcag aagaagcggt tgagcggtcg tacacgaaag ttgtcagcta tttaaaggag 300
 cgagatgaac tgtttgtttt cgaaggattt gccggagcag acgagaaata caggctgcgcg 360

atcactgtcg	taaatgagtt	cgcattggcac	aatttatttg	cgcggcagct	gtttatccgt	420
ccggaaggaa	atgataagaa	aacagttgag	cagccgttca	ccattctttc	tgctccgat	480
ttcaaacggg	atccaaaaac	agacggcact	cattccgaaa	cgtttattat	tgctcttttc	540
gaaaagcgga	caattttaat	cggcggaact	gagtatgccg	gtgaaatgaa	gaagtccatt	600
ttctccatta	tgaatttctt	gctgctgaa	agagatattt	tatctatgca	ctgctccgcc	660
aatgtcgggt	aaaaaggcga	tgctgccttt	ttcttcggac	tgctcaggaac	aggaaagacc	720
acctgtcgcg	cagatgctga	ccgcaagctg	atcggtgacg	atgaacatgg	ctggctctgat	780
acaggcgctct	ttaatatgta	aggcggatgc	tacgctaagt	gtattcattt	aagcgaggaa	840
aaggagccga	aaatctttta	cgcgatccgc	ttcgggtctg	ttctcgaaaa	tgctgttgtg	900
gattgaagata	cacgcgaagc	caattatgat	gattccttct	atactgaaaa	cacgcgggca	960
gcttaccoga	ttcatatgat	taataacatc	gtgaactccaa	gcattggccgg	ccatccgtca	1020
gccattgtat	ttttgacggc	tgatgccttc	ggagtctctg	cgcgcgatcg	caaaactaacg	1080
aaggagcagg	tgatgtacca	ttttttgagc	ggttacacga	gtaagcttgc	cggaaccggaa	1140
cggtggttca	cgtctcctga	aacgacgttt	tctacatgct	tcggctcacc	gttctcgccg	1200
cttctctgct	acgtctatgc	tgaatgtctc	ggcaaaaaga	tcgatgaaca	cgcgccagac	1260
gttttcttag	tcaataccgg	atggaccggg	ggcggtctacg	gcacaggcga	acgaatgaag	1320
ctttcttaca	ctagagcaat	ggtcaaagca	gcgattgaag	gcaaatatga	ggatgctgaa	1380
atgataacct	acgatatatt	cggcctgcac	attccggccc	atgttctctg	cgttctctgat	1440
catatccttc	agcctgaaaa	cacgtggacc	aaacaaggaa	aatcaaaaga	aaaaagcgtc	1500
taccttgcaa	atgaattcaa	agagaacttt	aaaaagttcg	cacataccga	tgccatcgcc	1560
caggcaggcg	gccctctctg	a				1581

<210> 28
 <211> 527
 <212> PRT
 <213> Bacillus subtilis

<400> 28
 Met Asn Ser Val Asp Leu Thr Ala Asp Leu Gln Ala Leu Leu Thr Cys
 1 5 10 15
 Pro Asn Val Arg His Asn Leu Ser Ala Ala Gln Leu Thr Glu Lys Val
 20 25 30
 Leu Ser Arg Asn Glu Gly Ile Leu Thr Ser Thr Gly Ala Val Arg Ala
 35 40 45
 Thr Thr Gly Ala Tyr Thr Gly Arg Ser Pro Lys Asp Lys Phe Ile Val
 50 55 60
 Glu Glu Glu Ser Thr Lys Asn Lys Ile Asp Trp Gly Pro Val Asn Gln
 65 70 75 80
 Pro Ile Ser Glu Glu Ala Phe Glu Arg Leu Tyr Thr Lys Val Val Ser
 85 90 95
 Tyr Leu Lys Glu Arg Asp Glu Leu Phe Val Phe Glu Gly Phe Ala Gly
 100 105 110
 Ala Asp Glu Lys Tyr Arg Leu Pro Ile Thr Val Val Asn Glu Phe Ala
 115 120 125
 Trp His Asn Leu Phe Ala Arg Gln Leu Phe Ile Arg Pro Glu Gly Asn
 130 135 140
 Asp Lys Lys Thr Val Glu Gln Pro Phe Thr Ile Leu Ser Ala Pro His
 145 150 155 160
 Phe Lys Ala Asp Pro Lys Thr Asp Gly Thr His Ser Glu Thr Phe Ile
 165 170 175
 Ile Val Ser Phe Glu Lys Arg Thr Ile Leu Ile Gly Gly Thr Glu Tyr
 180 185 190
 Ala Gly Glu Met Lys Lys Ser Ile Phe Ser Ile Met Asn Phe Leu Leu
 195 200 205
 Pro Glu Arg Asp Ile Leu Ser Met His Cys Ser Ala Asn Val Gly Glu
 210 215 220
 Lys Gly Asp Val Ala Leu Phe Phe Gly Leu Ser Gly Thr Gly Lys Thr

225 230 235 240
 Thr Leu Ser Ala Asp Ala Asp Arg Lys Leu Ile Gly Asp Asp Glu His
 245 250 255
 Gly Trp Ser Asp Thr Gly Val Phe Asn Ile Glu Gly Gly Cys Tyr Ala
 260 265 270
 Lys Cys Ile His Leu Ser Glu Glu Lys Glu Pro Gln Ile Phe Asn Ala
 275 280 285
 Ile Arg Phe Gly Ser Val Leu Glu Asn Val Val Val Asp Glu Asp Thr
 290 295 300
 Arg Glu Ala Asn Tyr Asp Asp Ser Phe Tyr Thr Glu Asn Thr Arg Ala
 305 310 315 320
 Ala Tyr Pro Ile His Met Ile Asn Asn Ile Val Thr Pro Ser Met Ala
 325 330 335
 Gly His Pro Ser Ala Ile Val Phe Leu Thr Ala Asp Ala Phe Gly Val
 340 345 350
 Leu Pro Pro Ile Ser Lys Leu Thr Lys Glu Gln Val Met Tyr His Phe
 355 360 365
 Leu Ser Gly Tyr Thr Ser Lys Leu Ala Gly Thr Glu Arg Gly Val Thr
 370 375 380
 Ser Pro Glu Thr Thr Phe Ser Thr Cys Phe Gly Ser Pro Phe Leu Pro
 385 390 395 400
 Leu Pro Ala His Val Tyr Ala Glu Met Leu Gly Lys Lys Ile Asp Glu
 405 410 415
 His Gly Ala Asp Val Phe Leu Val Asn Thr Gly Trp Thr Gly Gly Gly
 420 425 430
 Tyr Gly Thr Gly Glu Arg Met Lys Leu Ser Tyr Thr Arg Ala Met Val
 435 440 445
 Lys Ala Ala Ile Glu Gly Lys Leu Glu Asp Ala Glu Met Ile Thr Asp
 450 455 460
 Asp Ile Phe Gly Leu His Ile Pro Ala His Val Pro Gly Val Pro Asp
 465 470 475 480
 His Ile Leu Gln Pro Glu Asn Thr Trp Thr Asn Lys Glu Glu Tyr Lys
 485 490 495
 Glu Lys Ala Val Tyr Leu Ala Asn Glu Phe Lys Glu Asn Phe Lys Lys
 500 505 510
 Phe Ala His Thr Asp Ala Ile Ala Gln Ala Gly Gly Pro Leu Val
 515 520 525

<210> 29
 <211> 762
 <212> DNA
 <213> *Bacillus subtilis*

<400> 29
 ttgttaacag ccttaaaaaac agatacagga aaaatccgcc agcataatga agatgatgcg 60
 gggatattca aggggaaaaga tgaatttata ttacggtgtg tcgctgatgg catggggcgc 120
 catcttgctg gagatgttgc gagcaagatg gctgtgaaag ccattggggga gaaatggaat 180
 gaagcagaga cgattccaac tgcgccctcg gaatgtgaaa aatggctcat tgaacagatt 240
 ctatcggtaa acagcaaaat atacgatcac gctcaagccc acgaagaatg ccaaggcatg 300
 gggacgacga ttgtatgtgc actttttacg gggaaaacgg ttctgtttgc ccatatcgga 360
 gacagcagat gctatttgct tcaggacgat gatttcgttc aagtgcagga agaccattcg 420
 ctgttaaatg aactgggttc cactggagag atttcagag agaacgctga acatcatccg 480
 cgaaaaaatg tgttgacgaa ggcgcttggg acagaccagt tagtcagtat tgacaccogt 540
 tcctttgata tagaaccogg agacaaactg cttctatggt ctgacggact gacaaataaa 600
 gtggaaggca ctgagttaaa agacatcctg caaagcgatt cagctcctca ggaataaagta 660
 aactcgcttg tggacaaagc caatcagaat gccggagaag acaacattac agcagttttg 720
 cttgagcttg ctttacaagt tgaagagggg gaagatcagt gc 762

<210> 30
 <211> 254
 <212> PRT
 <213> *Bacillus subtilis*

<400> 30
 Met Leu Thr Ala Leu Lys Thr Asp Thr Gly Lys Ile Arg Gln His Asn
 1 5 10 15
 Glu Asp Asp Ala Gly Ile Phe Lys Gly Lys Asp Glu Phe Ile Leu Ala
 20 25 30
 Val Val Ala Asp Gly Met Gly Gly His Leu Ala Gly Asp Val Ala Ser
 35 40 45
 Lys Met Ala Val Lys Ala Met Gly Glu Lys Trp Asn Glu Ala Glu Thr
 50 55 60
 Ile Pro Thr Ala Pro Ser Glu Cys Glu Lys Trp Leu Ile Glu Gln Ile
 65 70 75 80
 Leu Ser Val Asn Ser Lys Ile Tyr Asp His Ala Gln Ala His Glu Glu
 85 90 95
 Cys Gln Gly Met Gly Thr Thr Ile Val Cys Ala Leu Phe Thr Gly Lys
 100 105 110
 Thr Val Ser Val Ala His Ile Gly Asp Ser Arg Cys Tyr Leu Leu Gln
 115 120 125
 Asp Asp Asp Phe Val Gln Val Thr Glu Asp His Ser Leu Val Asn Glu
 130 135 140
 Leu Val Arg Thr Gly Glu Ile Ser Arg Glu Asp Ala Glu His His Pro
 145 150 155 160
 Arg Lys Asn Val Leu Thr Lys Ala Leu Gly Thr Asp Gln Leu Val Ser
 165 170 175
 Ile Asp Thr Arg Ser Phe Asp Ile Glu Pro Gly Asp Lys Leu Leu Leu
 180 185 190
 Cys Ser Asp Gly Leu Thr Asn Lys Val Glu Gly Thr Glu Leu Lys Asp
 195 200 205
 Ile Leu Gln Ser Asp Ser Ala Pro Gln Glu Lys Val Asn Leu Leu Val
 210 215 220
 Asp Lys Ala Asn Gln Asn Gly Gly Glu Asp Asn Ile Thr Ala Val Leu
 225 230 235 240
 Leu Glu Leu Ala Leu Gln Val Glu Glu Gly Glu Asp Gln Cys
 245 250

<210> 31
 <211> 1545
 <212> DNA
 <213> *Bacillus subtilis*

<400> 31
 atgacagtcata catacgcgca cgaaccattt accgatttta cggaagcaaa gaataaaaact 60
 gcattttgggg agtcatttggc ctttgtaaac actcagctcg gcaagcatta tccgcttgtc 120
 ataaatggag aaaaaattga aacggaccgc aaaatcattt ctattaaccc ggcaaatataa 180
 gaagagatca ttgggtacgc gtctacagcg gatcaagagc ttgctgaaaa agcgatgcaa 240
 gccgcatcgc aggcatttga ttctggaaaa aaacaaagac cggagcaccc cgcaaatatt 300
 ctctttaagg cagcggctat ttggcgaga agaaagcatg aattttcaag ctactttgtg 360
 aaggaagcag gaaaaaccgtg gaagggaagca gatcgggaca cggctgaagc gatagacttt 420
 ttagagtctt acgcgcgcga aatgttaaac ctcaaggaa gggctccggt gaagagccgt 480
 gctggcgagg tcaatcaata tcattacgaa gcgcttggcg tcggcatcgt catttctcca 540
 ttttaacttc cgctcgcgat tatggcggga acagcggtgg cagcgattgt gacaggaaat 600
 acgattctct taaaaccgco tgaacgagcc ccggtagtgg cagcaaaatt tgtcgaggtc 660

atggaggaag	cggtgtctgc	aaacggcggt	ctgaattaca	ttccgggaga	tggtgcggag	720
atcggtgatt	tcttagttga	gcatacgaag	acacggtttg	tctcatttac	aggttcccg	780
gcagtcggct	gccggattta	tgagcgagct	gccaaagtgc	agccgggcca	aaaatggctc	840
aaacgggtaa	ttagcagaaat	ggcggaagaa	gacacagctg	ttgtcgacaa	ggacgctgat	900
cttgaccttg	ctgcatactc	tatcgtgtat	tcagcatttg	gatattcagg	acagaagtgt	960
tctgcgggct	ccccgcgggt	cattcatcag	gatgtgtatg	atgaagtggg	ggaaaaagct	1020
gtggcgctga	ccaaaaacgt	gactgtcggc	aatccagaag	atcctgatac	gtatatgggt	1080
cccgtgattc	atgaagcctc	ctacaacaaa	gtgatgaaat	acattgaaat	cggcaaatct	1140
gaaggcaagc	tattggccgg	cggagaagcg	gatgattcaa	aaggctactt	tattcagccg	1200
acgatctttg	cagatgttga	tgaaaacgcc	cgtttgatgc	aggaagaaat	tttcggcccg	1260
gttgttcgga	tttgcaaacg	cggtgatctc	gatcatatgc	tggagattgc	caataaacag	1320
gaatacggat	taacaggtgc	gctttctgacg	aaaaacccgtg	cgcacattga	acgggcgcgc	1380
gaggatttcc	atgtcggaaa	cctatatattt	aacagaggat	gtaccggagc	aattgtcggc	1440
tatcagccgt	tcggcggttt	taatatgtca	ggaacagact	caaaagcagg	cggtcccgat	1500
tacttaattc	ttcatatgca	agccaaaaaca	acgtccgaag	ctttt		1560

<210> 32
 <211> 515
 <212> PRT
 <213> *Bacillus subtilis*

<400> 32

Met	Thr	Val	Thr	Tyr	Ala	His	Glu	Pro	Phe	Thr	Asp	Phe	Thr	Glu	Ala
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Lys	Asn	Lys	Thr	Ala	Phe	Gly	Glu	Ser	Leu	Ala	Phe	Val	Asn	Thr	Gln
			20					25					30		
Leu	Gly	Lys	His	Tyr	Pro	Leu	Val	Ile	Asn	Gly	Glu	Lys	Ile	Glu	Thr
		35					40					45			
Asp	Arg	Lys	Ile	Ile	Ser	Ile	Asn	Pro	Ala	Asn	Lys	Glu	Glu	Ile	Ile
		50				55					60				
Gly	Tyr	Ala	Ser	Thr	Ala	Asp	Gln	Glu	Leu	Ala	Glu	Lys	Ala	Met	Gln
		65			70					75				80	
Ala	Ala	Leu	Gln	Ala	Phe	Asp	Ser	Trp	Lys	Lys	Gln	Arg	Pro	Glu	His
			85						90					95	
Arg	Ala	Asn	Ile	Leu	Phe	Lys	Ala	Ala	Ile	Leu	Arg	Arg	Arg	Lys	
		100					105					110			
His	Glu	Phe	Ser	Ser	Tyr	Leu	Val	Lys	Glu	Ala	Gly	Lys	Pro	Trp	Lys
		115					120					125			
Glu	Ala	Asp	Ala	Asp	Thr	Ala	Glu	Ala	Ile	Asp	Phe	Leu	Glu	Phe	Tyr
		130			135						140				
Ala	Arg	Gln	Met	Leu	Lys	Leu	Lys	Glu	Gly	Ala	Pro	Val	Lys	Ser	Arg
		145			150					155				160	
Ala	Gly	Glu	Val	Asn	Gln	Tyr	His	Tyr	Glu	Ala	Leu	Gly	Val	Gly	Ile
			165						170				175		
Val	Ile	Ser	Pro	Phe	Asn	Phe	Pro	Leu	Ala	Ile	Met	Ala	Gly	Thr	Ala
			180					185					190		
Val	Ala	Ala	Ile	Val	Thr	Gly	Asn	Thr	Ile	Leu	Leu	Lys	Pro	Ala	Asp
		195					200					205			
Ala	Ala	Pro	Val	Val	Ala	Ala	Lys	Phe	Val	Glu	Val	Met	Glu	Glu	Ala
		210				215					220				
Gly	Leu	Pro	Asn	Gly	Val	Leu	Asn	Tyr	Ile	Pro	Gly	Asp	Gly	Ala	Glu
		225			230					235					240
Ile	Gly	Asp	Phe	Leu	Val	Glu	His	Pro	Lys	Thr	Arg	Phe	Val	Ser	Phe
			245						250				255		
Thr	Gly	Ser	Arg	Ala	Val	Gly	Cys	Arg	Ile	Tyr	Glu	Arg	Ala	Ala	Lys
			260				265						270		
Val	Gln	Pro	Gly	Gln	Lys	Trp	Leu	Lys	Arg	Val	Ile	Ala	Glu	Met	Gly

275 280 285
 Gly Lys Asp Thr Val Leu Val Asp Lys Asp Ala Asp Leu Asp Leu Ala
 290 295 300
 Ala Ser Ser Ile Val Tyr Ser Ala Phe Gly Tyr Ser Gly Gln Lys Cys
 305 310 315 320
 Ser Ala Gly Ser Arg Ala Val Ile His Gln Asp Val Tyr Asp Glu Val
 325 330 335
 Val Glu Lys Ala Val Ala Leu Thr Lys Thr Leu Thr Val Gly Asn Pro
 340 345 350
 Glu Asp Pro Asp Thr Tyr Met Gly Pro Val Ile His Glu Ala Ser Tyr
 355 360 365
 Asn Lys Val Met Lys Tyr Ile Glu Ile Gly Lys Ser Glu Gly Lys Leu
 370 375 380
 Leu Ala Gly Gly Glu Gly Asp Ser Lys Gly Tyr Phe Ile Gln Pro
 385 390 395 400
 Thr Ile Phe Ala Asp Val Asp Glu Asn Ala Arg Leu Met Gln Glu Glu
 405 410 415
 Ile Phe Gly Pro Val Val Ala Ile Cys Lys Ala Arg Asp Phe Asp His
 420 425 430
 Met Leu Glu Ile Ala Asn Asn Thr Glu Tyr Gly Leu Thr Gly Ala Leu
 435 440 445
 Leu Thr Lys Asn Arg Ala His Ile Glu Arg Ala Arg Glu Asp Phe His
 450 455 460
 Val Gly Asn Leu Tyr Phe Asn Arg Gly Cys Thr Gly Ala Ile Val Gly
 465 470 475 480
 Tyr Gln Pro Phe Gly Gly Phe Asn Met Ser Gly Thr Asp Ser Lys Ala
 485 490 495
 Gly Gly Pro Asp Tyr Leu Ile Leu His Met Gln Ala Lys Thr Thr Ser
 500 505 510
 Glu Ala Phe
 515

<210> 33
 <211> 1203
 <212> DNA
 <213> *Bacillus subtilis*

<400> 33
 atgacagctt tatctaaatc caaagaaatt attgatcaga cgtctcatta cggagccaac 60
 aattatcacc cgtcccgat tgttatttct gaagcgctgg gtgcttgggt aaaggaccgc 120
 gaaggcaatg aatatatgga tatgctgagt gcttactctg cggtaaacca ggggcacaga 180
 caccgaaaa tcattcaggc attaaaggat caggctgata aaatcaccct cacgtcacgc 240
 gcgtttcata acgatcagct tgggcccgttt tacgaaaaaa cagctaaact gacaggcaaa 300
 gagatgattc tgccgatgaa tacaggagcc gaagcggttg aatcccggtg gaaagcggcg 360
 agacgctggg cgtatgaagt gaagggcgta gctgacaatc aagcggaaat tatcgcatgt 420
 gtcgggaact tccacggcgc cagcatgctg cgggtatctc ttctctctga agaggaatat 480
 aaacgaggat tcggcccgat gcttccagga atcaaaactca ttcccttacgg cgaatgggaa 540
 gcgcttcgac aggcattac gccgaataca gcggcattct tgtttgaacc gattcaaggc 600
 gaagcgggca ttgtgattcc gcctgaagga tttttacagg aagcggcggc gatttgaag 660
 gaagagataa totgttttat tgcggatgaa attcagacgg gtctcggacg tacaggcaag 720
 acgtttgcct gtgactggga cggcattgtt ccggatattg atattctggg caaagcgctt 780
 ggcggcggtg tgttcccgat ctottgcatt gcggcggaac tgcgatctct aggcgtgttt 840
 aacctggct caccggctc aacatttggg ggaacccgcg tgcgatgtgc agtgtctatc 900
 gcttcattag aagtgcctga ggatgaaaag ctggcggtac gttctcttga acttggtgaa 960
 tactttaaaa gcagatttga gattattgac agccctgtca taaagaaagt ccgcggcaga 1020
 gggctgttta tcggtgtgga attgactgaa cgggcacgtc cgtattgtga gcgtttgaag 1080
 gaagagggac ttttatgcaa ggaacgcgat gatacagtca ttcgtttgc accgccatta 1140

atcatttcca aagaggactt ggattgggcg atagagaaaa ttaagcacgt gctgcgaaac 1200
gca 1203

<210> 34
<211> 401
<212> PRT
<213> *Bacillus subtilis*

<400> 34
Met Thr Ala Leu Ser Lys Ser Lys Glu Ile Ile Asp Gln Thr Ser His
1 5 10 15
Tyr Gly Ala Asn Asn Tyr His Pro Leu Pro Ile Val Ile Ser Glu Ala
20 25 30
Leu Gly Ala Trp Val Lys Asp Pro Glu Gly Asn Glu Tyr Met Asp Met
35 40 45
Leu Ser Ala Tyr Ser Ala Val Asn Gln Gly His Arg His Pro Lys Ile
50 55 60
Ile Gln Ala Leu Lys Asp Gln Ala Asp Lys Ile Thr Leu Thr Ser Arg
65 70 75 80
Ala Phe His Asn Asp Gln Leu Gly Pro Phe Tyr Glu Lys Thr Ala Lys
85 90 95
Leu Thr Gly Lys Glu Met Ile Leu Pro Met Asn Thr Gly Ala Glu Ala
100 105 110
Val Glu Ser Ala Val Lys Ala Ala Arg Arg Trp Ala Tyr Glu Val Lys
115 120 125
Gly Val Ala Asp Asn Gln Ala Glu Ile Ile Ala Cys Val Gly Asn Phe
130 135 140
His Gly Arg Thr Met Leu Ala Val Ser Leu Ser Ser Glu Glu Glu Tyr
145 150 155 160
Lys Arg Gly Phe Gly Pro Met Leu Pro Gly Ile Lys Leu Ile Pro Tyr
165 170 175
Gly Asp Val Glu Ala Leu Arg Gln Ala Ile Thr Pro Asn Thr Ala Ala
180 185 190
Phe Leu Phe Glu Pro Ile Gln Gly Glu Ala Gly Ile Val Ile Pro Pro
195 200 205
Glu Gly Phe Leu Gln Glu Ala Ala Ala Ile Cys Lys Glu Glu Asn Val
210 215 220
Leu Phe Ile Ala Asp Glu Ile Gln Thr Gly Leu Gly Arg Thr Gly Lys
225 230 235 240
Thr Phe Ala Cys Asp Trp Asp Gly Ile Val Pro Asp Met Tyr Ile Leu
245 250 255
Gly Lys Ala Leu Gly Gly Gly Val Phe Pro Ile Ser Cys Ile Ala Ala
260 265 270
Asp Arg Glu Ile Leu Gly Val Phe Asn Pro Gly Ser His Gly Ser Thr
275 280 285
Phe Gly Gly Asn Pro Leu Ala Cys Ala Val Ser Ile Ala Ser Leu Glu
290 295 300
Val Leu Glu Asp Glu Lys Leu Ala Asp Arg Ser Leu Glu Leu Gly Glu
305 310 315 320
Tyr Phe Lys Ser Glu Leu Glu Ser Ile Asp Ser Pro Val Ile Lys Glu
325 330 335
Val Arg Gly Arg Gly Leu Phe Ile Gly Val Glu Leu Thr Glu Ala Ala
340 345 350
Arg Pro Tyr Cys Glu Arg Leu Lys Glu Glu Gly Leu Leu Cys Lys Glu
355 360 365
Thr His Asp Thr Val Ile Arg Phe Ala Pro Pro Leu Ile Ile Ser Lys
370 375 380

Glu Asp Leu Asp Trp Ala Ile Glu Lys Ile Lys His Val Leu Arg Asn
 385 390 395 400
 Ala

<210> 35
 <211> 888
 <212> DNA
 <213> *Bacillus subtilis*

<400> 35
 atggataaaa cgatttcggt tattggaatg ccaatggatt taggacaagc acgacgcgga 60
 gtggatatgg gcccgagtg cctccggtag gctcatctga tcgagaggct gtcagacatg 120
 gggatatacgg ttgaagatct cggtagacatt cggatcaatc gcgaaaaaat caaaatgac 180
 gaggaactga aaaacctgaa ttccgttttg gcgggaaatg aaaaactcgc gcaaaaggtc 240
 aacaaagtca ttgaagagaa aaaattcccg cttgtcctgg gcggtgacca cagtattgcg 300
 atcggcacgc ttgcaggcac agcgaagcat tacgataatc tcggcgctcat ctggtatgac 360
 gcgcacggcg atttgaatac acttgaactc tcaccatcgg gcaatatcca cggcatgcgc 420
 ctgcgggtca gcctaggcat tggccacgag tcactgggta accttgaagg ctacgcgcct 480
 aaaatcaaac cggaaaaacgt cgtcatcatt ggccgcccgt cacttgatga aggggagcgc 540
 aagtaacatta aggaagcgcg catgaagggtg tacacaatgc acgaaatcga tctcttggc 600
 atgacaaaag tcattgaaga aaccttgcgt tatattatcag catgtgatgg cgtccatctg 660
 agccttgatc tggacggact tgatccgaac gacgcaccgg gtgtcggaac cctgtgcgtc 720
 gcggcgcatc gctaccggga gagccatttg gctatggaaa tgctgtatga cgcaggcatc 780
 attacctcag ccgaattcgt tgaggttaac ccgatccttg atcacaataa caaacgcggc 840
 aaaaacgcag tagagctcgt agaacccttg ttagggaaga agctgctg 888

<210> 36
 <211> 296
 <212> PRT
 <213> *Bacillus subtilis*

<400> 36
 Met Asp Lys Thr Ile Ser Val Ile Gly Met Pro Met Asp Leu Gly Gln
 1 5 10 15
 Ala Arg Arg Gly Val Asp Met Gly Pro Ser Ala Ile Arg Tyr Ala His
 20 25 30
 Leu Ile Glu Arg Leu Ser Asp Met Gly Tyr Thr Val Glu Asp Leu Gly
 35 40 45
 Asp Ile Pro Ile Asn Arg Glu Lys Ile Lys Asn Asp Glu Glu Leu Lys
 50 55 60
 Asn Leu Asn Ser Val Leu Ala Gly Asn Glu Lys Leu Ala Gln Lys Val
 65 70 75 80
 Asn Lys Val Ile Glu Glu Lys Lys Phe Pro Leu Val Leu Gly Gly Asp
 85 90 95
 His Ser Ile Ala Ile Gly Thr Leu Ala Gly Thr Ala Lys His Tyr Asp
 100 105 110
 Asn Leu Gly Val Ile Trp Tyr Asp Ala His Gly Asp Leu Asn Thr Leu
 115 120 125
 Glu Thr Ser Pro Ser Gly Asn Ile His Gly Met Pro Leu Ala Val Ser
 130 135 140
 Leu Gly Ile Gly His Glu Ser Leu Val Asn Leu Glu Gly Tyr Ala Pro
 145 150 155 160
 Lys Ile Lys Pro Glu Asn Val Val Ile Ile Gly Ala Arg Ser Leu Asp
 165 170 175
 Glu Gly Glu Arg Lys Tyr Ile Lys Glu Ser Gly Met Lys Val Tyr Thr
 180 185 190

Met His Glu Ile Asp Arg Leu Gly Met Thr Lys Val Ile Glu Glu Thr
 195 200 205
 Leu Asp Tyr Leu Ser Ala Cys Asp Gly Val His Leu Ser Leu Asp Leu
 210 215 220
 Asp Gly Leu Asp Pro Asn Asp Ala Pro Gly Val Gly Thr Pro Val Val
 225 230 235 240
 Gly Gly Ile Ser Tyr Arg Glu Ser His Leu Ala Met Glu Met Leu Tyr
 245 250 255
 Asp Ala Gly Ile Ile Thr Ser Ala Glu Phe Val Glu Val Asn Pro Ile
 260 265 270
 Leu Asp His Lys Asn Lys Thr Gly Lys Thr Ala Val Glu Leu Val Glu
 275 280 285
 Ser Leu Leu Gly Lys Lys Leu Leu
 290 295

<210> 37
 <211> 1041
 <212> DNA
 <213> *Bacillus subtilis*

<400> 37
 atgcagagtg gaaagatgaa agctctaagt aaaaaggacg gggcggttcgg tgcgtgtcgtg 60
 actgaagttc coattctcga gattgataaa catgaagtc tcataaaaagt gaaagccgct 120
 tccatattgc gcacggatgt ccacatttat aatggggatc aatggggcag tcagagaaac 180
 aaaacaccct atgttttcgg ccattgagttc agcggcatcg tagagggcgt gggagagaat 240
 gtcagcagtg taaaagtggg agagtatgtg tctgcggaaa cacacattgt ctgtgggtgaa 300
 tgtgtccctt gcctaaacagg aaaatctcat gtgtgtacca atactgcat aatcgggatg 360
 gacacggcag gctgtttttg ggagtatgta aaagttccag ctgataaact ttggagaaat 420
 cccgctgata tggaccgcgc gattgcttcc attcaagagc ctttaggaaa tgcagttcat 480
 accgtactcg agagccagcc tgcaggagga acgactgcag tcattggatg cggaccgatt 540
 ggtcttatgg ctgtttcggt tgcaaaaagca gcaggagctt ctcaggtgat agcgattgat 600
 aagaatgaat acaggctgag gcttgcaaaa caaatgggag cgaactgtac tgtttctatt 660
 gaaaaagaag acccgctcaa aattgtaagc gctttaaaga gtggagaagg agcagatctt 720
 gtttgtgaga tgtcgggcca tccctcagcg attgcccaag gtcttgcatg ggcgcgaat 780
 ggcggaagat ttcataattc cagcttgccg gaacatccgg tgacaattga ttgacgaat 840
 aaagtgtgat ttaaagggct taccatccaa ggaatcacag gaagaaaaat gttttcaaca 900
 tggcgccagg tgtctcagtt gatcagttca aacatgatcg atcttgacc tgttattacc 960
 catcagtttc cattagagga gtttgaaaaa ggtttcgaac tgatgagaag cggggcagtg 1020
 ggaagagtaa ttttaattcc a 1041

<210> 38
 <211> 347
 <212> PRT
 <213> *Bacillus subtilis*

<400> 38
 Met Gln Ser Gly Lys Met Lys Ala Leu Met Lys Lys Asp Gly Ala Phe
 1 5 10 15
 Gly Ala Val Leu Thr Glu Val Pro Ile Pro Glu Ile Asp Lys His Glu
 20 25 30
 Val Leu Ile Lys Val Lys Ala Ala Ser Ile Cys Gly Thr Asp Val His
 35 40 45
 Ile Tyr Asn Trp Asp Gln Trp Ala Arg Gln Arg Ile Lys Thr Pro Tyr
 50 55 60
 Val Phe Gly His Glu Phe Ser Gly Ile Val Glu Gly Val Gly Glu Asn
 65 70 75 80
 Val Ser Ser Val Lys Val Gly Glu Tyr Val Ser Ala Glu Thr His Ile

	85		90		95
Val Cys Gly	Glu Cys Val	Pro Cys Leu	Thr Gly Lys Ser	His Val Cys	
	100		105	110	
Thr Asn Thr	Ala Ile Ile Gly	Val Asp Thr	Ala Gly Cys Phe	Ala Glu	
	115		120	125	
Tyr Val Lys	Val Pro Ala Asp	Asn Ile Trp	Arg Asn Pro	Ala Asp Met	
	130		135	140	
Asp Pro Ser	Ile Ala Ser Ile	Gln Glu Pro	Leu Gly Asn	Ala Val His	
	145		150	155	
Thr Val Leu	Glu Ser Gln Pro	Ala Gly Gly Thr	Thr Ala Val	Ile Gly	
	165		170	175	
Cys Gly Pro	Ile Gly Leu Met	Ala Val Ala	Val Ala Lys	Ala Ala Gly	
	180		185	190	
Ala Ser Gln	Val Ile Ala Ile	Asp Lys Asn	Glu Tyr Arg	Leu Arg Leu	
	195		200	205	
Ala Lys Gln	Met Gly Ala Thr	Cys Thr Val	Ser Ile Glu	Lys Glu Asp	
	210		215	220	
Pro Leu Lys	Ile Val Ser Ala	Leu Thr Ser	Gly Glu Gly	Ala Asp Leu	
	225		230	235	
Val Cys Glu	Met Ser Gly His	Pro Ser Ala	Ile Ala Gln	Gly Leu Ala	
	245		250	255	
Met Ala Ala	Asn Gly Gly Arg	Phe His Ile	Leu Ser Leu	Pro Glu His	
	260		265	270	
Pro Val Thr	Ile Asp Leu Thr	Asn Lys Val	Val Phe Lys	Gly Leu Thr	
	275		280	285	
Ile Gln Gly	Ile Thr Gly Arg	Lys Met Phe	Ser Thr Trp	Arg Gln Val	
	290		295	300	
Ser Gln Leu	Ile Ser Ser Asn	Met Ile Asp	Leu Ala Pro	Val Ile Thr	
	305		310	315	
His Gln Phe	Pro Leu Glu Glu	Phe Glu Lys	Gly Phe Glu	Leu Met Arg	
	325		330	335	
Ser Gly Gln	Cys Gly Lys Val	Ile Leu Ile	Pro		
	340		345		

<210> 39

<211> 6127

<212> DNA

<213> *Bacillus subtilis*

<400> 39

taatacagata	agaacagctt	agaaatacac	aagagtgtgt	ataaagcaat	tagaatgagt	60
tgagtttagag	aatagggttag	cagagaatga	gttttagttga	gctgagacat	tatgtttatt	120
ctacccaaaa	gaagtctttc	ttttgggttt	atttgttata	tagtatttta	tcctctcatg	180
ccatcttctc	attctctctg	ccataaggag	tgagagcaat	gaatttccaa	tcaaacattt	240
ccgcattttt	agaggacagc	ttgtccacc	acacgatacc	gattgtggag	accttcacag	300
tcgatacact	gacacccact	caaagtatag	agaagcttga	cagggagagt	acgtatcttc	360
ttgaaagcaa	ggacgataca	tcactttggt	ccagatattc	gtttatcggc	ctgaatccat	420
ttctcacaat	taaaagaagag	cagggccgtt	tttcggccgc	tgatcaggac	agcaaatctc	480
tttacacagg	aaatgaacta	aaagaagtgc	tgaactggat	gaataccaca	tacaaaatca	540
aaacacatga	gctttggcctt	ccttttgtcg	gcggagctgt	cggtgactta	agctatgata	600
tgatcccgct	gattgagcct	tctgttcott	cgcataccaa	agaaacagac	atggaaaagt	660
glatgctgtt	tgtttgcggg	acattaattg	cgtatgatca	tgaacacaaa	aacgtccact	720
ttatccaaat	tgcaaggctc	actggagagg	aaacaaaaaa	cgaaaaatgt	gatgtattcc	780
atcaaaatca	tctggagctt	caaaatctca	ttgaaaaaat	gatggaccac	aaaaacatca	840
aagagctgtt	tctttctgct	gattcatata	agacaccacg	ctttgagaca	gtatcttcta	900
attatgaaa	atcggtttt	atggctgatg	tagaaaaaat	caaaagctat	ataaaagcag	960

gcgatattctt	ccaggggtgtt	ttatcacaaa	aatttgaggt	gccgataaaa	gcagatgctt	1020
ttgagttata	ccgagtgctt	aggatcgta	atccttcgcc	gtatagtat	tatatgaac	1080
tgctagacag	agaaatagtc	ggcagctctc	cggaaacggt	aatcacacct	caagacgggc	1140
acttagaaat	ccatccgatt	ccgggtacga	gaaaacgcgg	tcgacacaaa	gctgaagatg	1200
agagactgaa	ggttgagctc	atgaaggatg	aaaaagaaaa	agcggagcat	tacatgctcg	1260
ttgatcttgc	ccgaaaacat	atcggcagag	tagcagagta	tggttctgtt	ttctgtgccg	1320
agttcacaaa	aattgtttcc	ttttcacatg	tcatgcacat	tatctcggtg	gttacagacc	1380
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tttaaaa						6127

<210> 40
 <211> 801
 <212> DNA
 <213> *Bacillus subtilis*

<400> 40						
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gcttcaaaagc	gggcgcttga	tcaaggaaatg	aatatcgtaa	aggcaatcga	attaggcgga	240
gaaatgaaaa	aaaacggagt	gaatattccg	attatcctct	ttacgtatta	taactctgtg	300
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cttggtccgg	atctgocatt	agaagaaagc	aacagccttc	aagaggaaatg	taaaagccat	420
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gacgggtgtc	tagtgggaag	tgcgctcgtc	agaaaaatag	aagaattaaa	ggaccggtct	720
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<210> 41
 <211> 267
 <212> PRT
 <213> *Bacillus subtilis*

<400> 41
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Ile Thr Ala Gly Asp Pro Val Pro Glu Val Ser Ile Glu Leu Ala Lys
20 25 30
Ser Leu Gln Lys Ala Gly Ala Thr Ala Leu Glu Leu Gly Val Ala Tyr
35 40 45
Ser Asp Pro Leu Ala Asp Gly Pro Val Ile Gln Arg Ala Ser Lys Arg
50 55 60
Ala Leu Asp Gln Gly Met Asn Ile Val Lys Ala Ile Glu Leu Gly Gly
65 70 75 80
Glu Met Lys Lys Asn Gly Val Asn Ile Pro Ile Ile Leu Phe Thr Tyr
85 90 95
Tyr Asn Pro Val Leu Gln Leu Asn Lys Glu Tyr Phe Phe Ala Leu Leu
100 105 110
Arg Glu Asn His Ile Asp Gly Leu Leu Val Pro Asp Leu Pro Leu Glu
115 120 125
Glu Ser Asn Ser Leu Gln Glu Glu Cys Lys Ser His Glu Val Thr Tyr
130 135 140
Ile Ser Leu Val Ala Pro Thr Ser Glu Ser Arg Leu Lys Thr Ile Ile
145 150 155 160
Glu Gln Ala Glu Gly Phe Val Tyr Cys Val Ser Ser Leu Gly Val Thr
165 170 175
Gly Val Arg Asn Glu Phe Asn Ser Ser Val Tyr Pro Phe Ile Arg Thr
180 185 190
Val Lys Asn Leu Ser Thr Val Pro Val Ala Val Gly Phe Gly Ile Ser
195 200 205
Asn Arg Glu Gln Val Ile Lys Met Asn Glu Ile Ser Asp Gly Val Val
210 215 220
Val Gly Ser Ala Leu Val Arg Lys Ile Glu Glu Leu Lys Asp Arg Leu
225 230 235 240
Ile Ser Ala Glu Thr Arg Asn Gln Ala Leu Gln Glu Phe Glu Asp Tyr
245 250 255
Ala Met Ala Phe Ser Gly Leu Tyr Ser Leu Lys
260 265

<210> 42
<211> 1195
<212> DNA
<213> *Bacillus subtilis*

<400> 42
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gaaacactca tgcagccggt agatgaaata caaacagcat ttaacacaa caaggatgat 120
cccgtttttc gtgaagagta ttataagctg ttaaaggact attccggacg cccgactgca 180
ttaacatcac ctgactcgagt cactgaatac ttaggcggcg cgaaaaatcta ttgaaacga 240
gaagatttaa accatacagg ttctcataaa atcaataatg cgctagggtca agcgtgtggt 300
gctaaaaaaa tgggcaaaaac gaaaatcatt gctgaaaccg gtgccggcca gcatggtgtt 360
gccgctgcaa cagttgcagc caaatccggc ttttctgtga ctgtgtttat ggggtgaagag 420
gatgttgccc gccagctctc gaacgttttc cgcatagaac ttcttgagag ggaagttagtg 480
cctgtaacaa cgggaaacgg aacattgaag gatgccacaa atgaggcgat ccggtactgg 540
gttcagcatt gtgaggatca cttttatagt attggatcag ttgtcgcccc gcactcatt 600
ccgcaagtgg tccgtgaatt tcaaaaaatg atcggagagg aagcgaagga tcagttgaaa 660
cgtattgaag gcactatgcc tgataaagta gtggcatgtg taggcggagg aagcaatcgc 720
atgggtatgt ttacggcatt tttaaatgaa gatgttgaac tgatcggcgc tgaagcagca 780
ggaaaaggaa ttgatacacc tcttcatgcc gccactattt cgaaaaggaa cgtaggggtt 840
attcacggtt cattgactta tctcattcag gatgagttcg ggcaaatat tgagccctac 900

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agcggcgcgtg	tcaacttatga	cagtataacc	gatgaagaag	cggtggatgc	attaaagctt	1020
ttgtcagaaa	aagaggggat	tttgccggca	atcgaatctg	cccattcggtt	agcgaagca	1080
ttcaactcg	ccaaaggaat	ggatcgcggt	caactcattc	tcgtctgttt	atcaggccgg	1140
ggagacaagg	atgtcaacac	attaatgaat	gtattggaag	aagaggtgaa	agccc	1195

<210> 43
 <211> 400
 <212> PRT
 <213> *Bacillus subtilis*

<400> 43

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Lys	Phe	Val	Pro	Glu	Thr	Leu	Met	Gln	Pro	Leu	Asp	Glu	Ile	Gln	Thr	
			20					25					30			
Ala	Phe	Lys	Gln	Ile	Lys	Asp	Asp	Pro	Ala	Phe	Arg	Glu	Glu	Tyr	Tyr	
		35					40				45					
Lys	Leu	Leu	Lys	Asp	Tyr	Ser	Gly	Arg	Pro	Thr	Ala	Leu	Thr	Tyr	Ala	
	50				55				60							
Asp	Arg	Val	Thr	Glu	Tyr	Leu	Gly	Gly	Ala	Lys	Ile	Tyr	Leu	Lys	Arg	
65				70				75					80			
Glu	Asp	Leu	Asn	His	Thr	Gly	Ser	His	Lys	Ile	Asn	Asn	Ala	Leu	Gly	
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Gln	Ala	Leu	Leu	Ala	Lys	Lys	Met	Gly	Lys	Thr	Lys	Ile	Ile	Ala	Glu	
		100					105						110			
Thr	Gly	Ala	Gly	Gln	His	Gly	Val	Ala	Ala	Ala	Thr	Val	Ala	Ala	Lys	
	115						120					125				
Phe	Gly	Phe	Ser	Cys	Thr	Val	Phe	Met	Gly	Glu	Glu	Asp	Val	Ala	Arg	
	130				135						140					
Gln	Ser	Leu	Asn	Val	Phe	Arg	Met	Lys	Leu	Leu	Gly	Ala	Glu	Val	Val	
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Pro	Val	Thr	Ser	Gly	Asn	Gly	Thr	Leu	Lys	Asp	Ala	Thr	Asn	Glu	Ala	
			165					170					175			
Ile	Arg	Tyr	Trp	Val	Gln	His	Cys	Glu	Asp	His	Phe	Tyr	Met	Ile	Gly	
	180						185						190			
Ser	Val	Val	Gly	Pro	His	Pro	Tyr	Pro	Gln	Val	Val	Arg	Glu	Phe	Gln	
	195						200					205				
Lys	Met	Ile	Gly	Glu	Glu	Ala	Lys	Asp	Gln	Leu	Lys	Arg	Ile	Glu	Gly	
	210					215					220					
Thr	Met	Pro	Asp	Lys	Val	Val	Ala	Cys	Val	Gly	Gly	Gly	Ser	Asn	Ala	
	225				230				235					240		
Met	Gly	Met	Phe	Gln	Ala	Phe	Leu	Asn	Glu	Asp	Val	Glu	Leu	Ile	Gly	
			245					250					255			
Ala	Glu	Ala	Ala	Gly	Lys	Gly	Ile	Asp	Thr	Pro	Leu	His	Ala	Ala	Thr	
	260						265						270			
Ile	Ser	Lys	Gly	Thr	Val	Gly	Val	Ile	His	Gly	Ser	Leu	Thr	Tyr	Leu	
	275					280					285					
Ile	Gln	Asp	Glu	Phe	Gly	Gln	Ile	Ile	Glu	Pro	Tyr	Ser	Ile	Ser	Ala	
	290					295				300						
Gly	Leu	Asp	Tyr	Pro	Gly	Ile	Gly	Pro	Glu	His	Ala	Tyr	Leu	His	Lys	
	305				310					315					320	
Ser	Gly	Arg	Val	Thr	Tyr	Asp	Ser	Ile	Thr	Asp	Glu	Glu	Ala	Val	Asp	
			325					330					335			
Ala	Leu	Lys	Leu	Leu	Ser	Glu	Lys	Glu	Gly	Ile	Leu	Pro	Ala	Ile	Glu	
			340					345				350				
Ser	Ala	His	Ala	Leu	Ala	Lys	Ala	Phe	Lys	Leu	Ala	Lys	Gly	Met	Asp	

355 360 365
 Arg Gly Gln Leu Ile Leu Val Cys Leu Ser Gly Arg Gly Asp Lys Asp
 370 375 380
 Val Asn Thr Leu Met Asn Val Leu Glu Glu Glu Val Lys Ala His Val
 385 390 395 400

<210> 44
 <211> 757
 <212> DNA
 <213> *Bacillus subtilis*

<400> 44
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 ggggttgattg ccgaagtga gaaagcatcg ccgtcaaaaag ggcttattaa agaggatttt 180
 gtacctgtgc agattgcaaa agactatgag gctgcgaagg cagatgcgat ttccgtttta 240
 acagacacccc cgTTTTttca aggggaaaaac agctatttat cagacgtaaa gcgtgctgtt 300
 tcgattcctg tacttagaaa agatTTtatt attgattctc ttcaagtaga ggaatcaaga 360
 agaatcgagg cggatgccat attgttaac ggcgaggtgc ttgatccctt acaccttcat 420
 gaattatatc ttgaagcagg tgaagggggg atggacgtgt tagtgagggt tcatgatgca 480
 tcaacgctag acaaatattt gaaagtgttc acaccgcaca ttctcgccgt aaataatcga 540
 aacctaataa cgTTtgaaac atctgtaaaag cagacagaa aaatcgcatc tctcgttccg 600
 aaagaatcct tgcttgcag cgaaaagcgga atcggtttct tagaacattt aacatttgtc 660
 aatgaacatg gggcgcgagc tgtacttacc ggtgaatcat tgatgagaca aacttctcag 720
 cgtaaaagcaa tccatgcttt gtttagggag tgaggtt 757

<210> 45
 <211> 250
 <212> PRT
 <213> *Bacillus subtilis*

<400> 45
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 20 25 30
 Pro Ala Ser Pro Asn Arg Phe Ile Gly Leu Ile Ala Glu Val Lys Lys
 35 40 45
 Ala Ser Pro Ser Lys Gly Leu Ile Lys Glu Asp Phe Val Pro Val Gln
 50 55 60
 Ile Ala Lys Asp Tyr Glu Ala Ala Lys Ala Asp Ala Ile Ser Val Leu
 65 70 75 80
 Thr Asp Thr Pro Phe Phe Gln Gly Glu Asn Ser Tyr Leu Ser Asp Val
 85 90 95
 Lys Arg Ala Val Ser Ile Pro Val Leu Arg Lys Asp Phe Ile Ile Asp
 100 105 110
 Ser Leu Gln Val Glu Glu Ser Arg Arg Ile Gly Ala Asp Ala Ile Leu
 115 120 125
 Leu Ile Gly Glu Val Leu Asp Pro Leu His Leu His Glu Leu Tyr Leu
 130 135 140
 Glu Ala Gly Glu Lys Gly Met Asp Val Leu Val Glu Val His Asp Ala
 145 150 155 160
 Ser Thr Leu Glu Gln Ile Leu Lys Val Phe Thr Pro Asp Ile Leu Gly
 165 170 175
 Val Asn Asn Arg Asn Leu Lys Thr Phe Glu Thr Ser Val Lys Gln Thr
 180 185 190
 Glu Gln Ile Ala Ser Leu Val Pro Lys Glu Ser Leu Leu Val Ser Glu

195 200 205
 Ser Gly Ile Gly Ser Leu Glu His Leu Thr Phe Val Asn Glu His Gly
 210 215 220
 Ala Arg Ala Val Leu Ile Gly Glu Ser Leu Met Arg Gln Thr Ser Gln
 225 230 235 240
 Arg Lys Ala Ile His Ala Leu Phe Arg Glu
 245 250

<210> 46
 <211> 1009
 <212> DNA
 <213> *Bacillus subtilis*

<400> 46
 atgaacagat ttctacaatt gtgcgttgac ggaaaaaacc ttactgccgg tgaggctgaa 60
 acgctgatga atatgatgat ggcagcggaa atgactcctt ctgaaatggg ggggatattg 120
 tcaattcttg ctcacgagg ggagacgcca gaagagcttg cgggttttgg gaagcgaatg 180
 cgggcacacg cctctacagt ccatggactt cctgatattg ttgatacatg cggacacagg 240
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 gtttagaggg agctagaggt ttctattcaa accactccgc aaaaggtcaa aagcagcatt 420
 gaaacaaaac acatgggatt tctttttgcg ccgctttacc attcgtctat gaaacatgta 480
 gcaggtacta gaaaagagct aggtttoaaga acggtattta atctgcttgg gccgcctcagc 540
 aatoccttac aggcgaagcg tcaggtgatt ggggtctatt ctgttgaaaa agctggagctg 600
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 ggtttagatg agctttcaat tacagcaccg accgacgtga ttgaattaaa ggaacggagag 720
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 agcagcagtt ccgctttatc tattacggct tttaatgcgg gtgctgcgat ttacacggcg 900
 ggaattaccg cctcactgaa ggaaggaacg gagctggcgt tagagacgat tacaagcgga 960
 ggcgctgcgg cgcagcttga acgactaaag cagaaagagg aagagatct 1009

<210> 47
 <211> 338
 <212> PRT
 <213> *Bacillus subtilis*

<400> 47
 Met Asn Arg Phe Leu Gln Leu Cys Val Asp Gly Lys Thr Leu Thr Ala
 1 5 10 15
 Gly Glu Ala Glu Thr Leu Met Asn Met Met Met Ala Ala Glu Met Thr
 20 25 30
 Pro Ser Glu Met Gly Gly Ile Leu Ser Ile Leu Ala His Arg Gly Glu
 35 40 45
 Thr Pro Glu Glu Leu Ala Gly Phe Val Lys Ala Met Arg Ala His Ala
 50 55 60
 Leu Thr Val Asp Gly Leu Pro Asp Ile Val Asp Thr Cys Gly Thr Gly
 65 70 75 80
 Gly Asp Gly Ile Ser Thr Phe Asn Ile Ser Thr Ala Ser Ala Ile Val
 85 90 95
 Ala Ser Ala Ala Gly Ala Lys Ile Ala Lys His Gly Asn Arg Ser Val
 100 105 110
 Ser Ser Lys Ser Gly Ser Ala Asp Val Leu Glu Glu Leu Glu Val Ser
 115 120 125
 Ile Gln Thr Thr Pro Glu Lys Val Lys Ser Ser Ile Glu Thr Asn Asn
 130 135 140
 Met Gly Phe Leu Phe Ala Pro Leu Tyr His Ser Ser Met Lys His Val

145 150 155 160
 Ala Gly Thr Arg Lys Glu Leu Gly Phe Arg Thr Val Phe Asn Leu Leu
 165 170 175
 Gly Pro Leu Ser Asn Pro Leu Gln Ala Lys Arg Gln Val Ile Gly Val
 180 185 190
 Tyr Ser Val Glu Lys Ala Gly Leu Met Ala Ser Ala Leu Glu Thr Phe
 195 200 205
 Gln Pro Lys His Val Met Phe Val Ser Ser Arg Asp Gly Leu Asp Glu
 210 215 220
 Leu Ser Ile Thr Ala Pro Thr Asp Val Ile Glu Leu Lys Asp Gly Glu
 225 230 235 240
 Arg Arg Glu Tyr Thr Val Ser Pro Glu Asp Phe Gly Phe Thr Asn Gly
 245 250 255
 Arg Leu Glu Asp Leu Gln Val Gln Ser Pro Lys Glu Ser Ala Tyr Leu
 260 265 270
 Ile Gln Asn Ile Phe Glu Asn Lys Ser Ser Ser Ala Leu Ser Ile
 275 280 285
 Thr Ala Phe Asn Ala Gly Ala Ala Ile Tyr Thr Ala Gly Ile Thr Ala
 290 295 300
 Ser Leu Lys Glu Gly Thr Glu Leu Ala Leu Glu Thr Ile Thr Ser Gly
 305 310 315 320
 Gly Ala Ala Ala Gln Leu Glu Arg Leu Lys Gln Lys Glu Glu Glu Ile
 325 330 335
 Tyr Ala

<210> 48
 <211> 1519
 <212> DNA
 <213> *Bacillus subtilis*

<400> 48
 atgaatttcc aatcaaacat ttccgcatTT tttagaggaca gtttgtccca coacacgata 60
 ccgattgtgg agaccttcc agtcgatata ctgacaccca ttcaaatgat agagaagctt 120
 gacagggaga ttacgtatct tcttgaaagc aaggacgata catccacttg gtccagatat 180
 tcgtttatcg gcttgaatcc atttctcaca attaaagaag agcaggcgcc ttttccggcc 240
 gctgatcagg acagcaaatc tctttacaca ggaaatgaac taaaagaagt gctgaactgg 300
 atgaatacca catcaaaatc caaaacacct gagcttggca tctcttttgt cggcggagct 360
 gtccgggtact taagctatga tatgatcccg ctgattgagc cttctgttcc ttccgatacc 420
 aaagaaacag acatggaaaa gtgtatgctg ttgtttgccc ggacattaat tgcgtatgat 480
 catgaaacca aaaacgtcca ctttatccaa tatgcaaggc tcaactggaga ggaacaaaa 540
 aacgaaaaaa tggatgtatt ccatcaaaat catctggagc ttcaaaatct cattgaaaaa 600
 atgatggacc aaaaaaacat aaaagagctg tttctttctg ctgattcata caagacaccc 660
 agctttgaga cagtatcttc taattatgaa aaatcgggct ttagtgctga ttagaaaaa 720
 atcaaaagct atataaaagc aggcgatata ttccagggtg ttttatcaca aaaatttgag 780
 gtgccgataa aagcagatgc ttttgagtta taccagagtg ttaggatcgt caatcctctg 840
 ccgtatatgt attatatgaa actgctagac agagaaaatg tccggcagctc tccggaaacgg 900
 ttaatacacg ttcaagacgg gcacttagaa atccactccga ttgccggtac gagaaaaacg 960
 ggtgcagaca aagctgaaga tgagagactg aagggttgagc tcatgaagga tgaaaaaaga 1020
 aaagcggagc attacatgct cgttgatott gcccgaaacg atatcggcag atagcagag 1080
 tatggttctg tttctgtgcc ggagttcaca aaaattgttt ccttttcaca tgcctatgac 1140
 attatctcgg tggttacagg ccgattgaaa aaagggtgtc atcctgtcga tgcactgatg 1200
 tctgctttcc cggcggggg ttttaacaggc gcacccaaaa tccgtgccat gcagcttttg 1260
 caagaactcg agccaacacc gagagagata tacggagggt gtattgccta cattggggtt 1320
 gacgggaata tcgactcttg tattacgatt cgcacgatga gtgaataaga ccggtgttga 1380
 tcgatacagg caggtgctgg cattgttgct gattctgttc cggaagcga atacgaagaa 1440
 agctgtaata aagccggtgc gctgctgaaa acgattcata ttgcagaaga catgtttcat 1500

<210> 49
 <211> 515
 <212> PRT
 <213> *Bacillus subtilis*

<400> 49
 Met Asn Phe Gln Ser Asn Ile Ser Ala Phe Leu Glu Asp Ser Leu Ser
 1 5 10 15
 His His Thr Ile Pro Ile Val Glu Thr Phe Thr Val Asp Thr Leu Thr
 20 25 30
 Pro Ile Gln Met Ile Glu Lys Leu Asp Arg Glu Ile Thr Tyr Leu Leu
 35 40 45
 Glu Ser Lys Asp Asp Thr Ser Thr Trp Ser Arg Tyr Ser Phe Ile Gly
 50 55 60
 Leu Asn Pro Phe Leu Thr Ile Lys Glu Glu Gln Gly Arg Phe Ser Ala
 65 70 75 80
 Ala Asp Gln Asp Ser Lys Ser Leu Tyr Thr Gly Asn Glu Leu Lys Glu
 85 90 95
 Val Leu Asn Trp Met Asn Thr Thr Tyr Lys Ile Lys Thr Pro Glu Leu
 100 105 110
 Gly Ile Pro Phe Val Gly Gly Ala Val Gly Tyr Leu Ser Tyr Asp Met
 115 120 125
 Ile Pro Leu Ile Glu Pro Ser Val Pro Ser His Thr Lys Glu Thr Asp
 130 135 140
 Met Glu Lys Cys Met Leu Phe Val Cys Arg Thr Leu Ile Ala Tyr Asp
 145 150 155 160
 His Glu Thr Lys Asn Val His Phe Ile Gln Tyr Ala Arg Leu Thr Gly
 165 170 175
 Glu Glu Thr Lys Asn Glu Lys Met Asp Val Phe His Gln Asn His Leu
 180 185 190
 Glu Leu Gln Asn Leu Ile Glu Lys Met Met Asp Gln Lys Asn Ile Lys
 195 200 205
 Glu Leu Phe Leu Ser Ala Asp Ser Tyr Lys Thr Pro Ser Phe Glu Thr
 210 215 220
 Val Ser Ser Asn Tyr Glu Lys Ser Ala Phe Met Ala Asp Val Glu Lys
 225 230 235 240
 Ile Lys Ser Tyr Ile Lys Ala Gly Asp Ile Phe Gln Gly Val Leu Ser
 245 250 255
 Gln Lys Phe Glu Val Pro Ile Lys Ala Asp Ala Phe Glu Leu Tyr Arg
 260 265 270
 Val Leu Arg Ile Val Asn Pro Ser Pro Tyr Met Tyr Tyr Met Lys Leu
 275 280 285
 Leu Asp Arg Glu Ile Val Gly Ser Ser Pro Glu Arg Leu Ile His Val
 290 295 300
 Gln Asp Gly His Leu Glu Ile His Pro Ile Ala Gly Thr Arg Lys Arg
 305 310 315 320
 Gly Ala Asp Lys Ala Glu Asp Glu Arg Leu Lys Val Glu Leu Met Lys
 325 330 335
 Asp Glu Lys Glu Lys Ala Glu His Tyr Met Leu Val Asp Leu Ala Arg
 340 345 350
 Asn Asp Ile Gly Arg Val Ala Glu Tyr Gly Ser Val Ser Val Pro Glu
 355 360 365
 Phe Thr Lys Ile Val Ser Phe Ser His Val Met His Ile Ile Ser Val
 370 375 380
 Val Thr Gly Arg Leu Lys Lys Gly Val His Pro Val Asp Ala Leu Met

115 120 125
 Ile Asp Ser Ser Val Lys Gly Ser Arg Gly Gly Thr Gly Val Ala Phe
 130 135 140
 Ser Trp Asp Cys Val Pro Glu Tyr Gln Gln Ala Ala Ile Gly Lys Arg
 145 150 155 160
 Cys Phe Ile Ala Gly Gly Val Asn Pro Asp Ser Ile Thr Arg Leu Leu
 165 170 175
 Lys Trp Gln Pro Glu Gly Ile Asp Leu Ala Ser Gly Ile Glu Lys Asn
 180 185 190
 Gly Gln Lys Asp Gln Asn Leu Met Arg Leu Leu Glu Glu Arg Met Asn
 195 200 205
 Arg Tyr Val Ser Ile Ser Glu
 210 215

<210> 52
 <211> 909
 <212> DNA
 <213> *Bacillus subtilis*

<400> 52
 gtgatcacaa gagatttttt cttattttta tccaaaagcg gcttttctcaa taaaaatggcg 60
 aggaactggg gaagtctgggt agcagcgggt aaaattatcg gcgggaatga ctttaacagt 120
 tcaatccgca ccattcgaca gcttaacagc caaggcttgt cagtactgt cgatcattta 180
 ggcgagtttg tgaacagcgc cgaggtcgca cgggagcgta cgggaagagt ctttcaaaacc 240
 attgcgacca tcgctgatca ggagctgaac tcacacgttt ctttaaaaaat cagctcttta 300
 gggttgata tagatatgga ttgtgtgtat gaaaatatga caaaaatcct tcagacggcc 360
 gagaacata aaatcatggt caccattgac atggaggacg aagtcagatg ccagaaaaagc 420
 cttgatattt tcaaaagatt cagaaagaaa tacgagcatg tgagcacagt gctgcaagcc 480
 tatctgtacc ggacgaaaaa agacattgac gatttggatt ctttaaaacc gttccttgcg 540
 cttgtaaaag gagcttataa agaatcagaa aaagttagct tcccgagaaa aagcgatgct 600
 gatgaaaatt acaaaaaaat catccgaaag cagctcttaa acggtcacta tacagcgatt 660
 gccacacatg acgacaaaat gatcgacttt acaaaagcagc ttgccaaagg acatggcatt 720
 gccaatgaca agtttgaatt tcagatgctg tacggcatgc ggtcgcaaac ccagctcagc 780
 ctctgtaaaag aaggttataa catgagagtc tacctgccat acggcgagga ttggtacggc 840
 tactttatga gacgccttgc agaacgtccg tcaaacattg catttgcctt caaaggaagt 900
 acaagaag 909

<210> 53
 <211> 303
 <212> PRT
 <213> *Bacillus subtilis*

<400> 53
 Met Ile Thr Arg Asp Phe Phe Leu Phe Leu Ser Lys Ser Gly Phe Leu
 1 5 10 15
 Asn Lys Met Ala Arg Asn Trp Gly Ser Arg Val Ala Ala Gly Lys Ile
 20 25 30
 Ile Gly Gly Asn Asp Phe Asn Ser Ser Ile Pro Thr Ile Arg Gln Leu
 35 40 45
 Asn Ser Gln Gly Leu Ser Val Thr Val Asp His Leu Gly Glu Phe Val
 50 55 60
 Asn Ser Ala Glu Val Ala Arg Glu Arg Thr Glu Glu Cys Ile Gln Thr
 65 70 75 80
 Ile Ala Thr Ile Ala Asp Gln Glu Leu Asn Ser His Val Ser Leu Lys
 85 90 95
 Met Thr Ser Leu Gly Leu Asp Ile Asp Met Asp Leu Val Tyr Glu Asn
 100 105 110

Met Thr Lys Ile Leu Gln Thr Ala Glu Lys His Lys Ile Met Val Thr
115 120 125
Ile Asp Met Glu Asp Glu Val Arg Cys Gln Lys Thr Leu Asp Ile Phe
130 135 140
Lys Asp Phe Arg Lys Lys Tyr Glu His Val Ser Thr Val Leu Gln Ala
145 150 155
Tyr Leu Tyr Arg Thr Glu Lys Asp Ile Asp Asp Leu Asp Ser Leu Asn
165 170 175
Pro Phe Leu Arg Leu Val Lys Gly Ala Tyr Lys Glu Ser Glu Lys Val
180 185 190
Ala Phe Pro Glu Lys Ser Asp Val Asp Glu Asn Tyr Lys Lys Ile Ile
195 200 205
Arg Lys Gln Leu Leu Asn Gly His Tyr Thr Ala Ile Ala Thr His Asp
210 215 220
Asp Lys Met Ile Asp Phe Thr Lys Gln Leu Ala Lys Glu His Gly Ile
225 230 235
Ala Asn Asp Lys Phe Glu Phe Gln Met Leu Tyr Gly Met Arg Ser Gln
245 250 255
Thr Gln Leu Ser Leu Val Lys Glu Gly Tyr Asn Met Arg Val Tyr Leu
260 265 270
Pro Tyr Gly Glu Asp Trp Tyr Gly Tyr Phe Met Arg Arg Leu Ala Glu
275 280 285
Arg Pro Ser Asn Ile Ala Phe Ala Phe Lys Gly Met Thr Lys Lys
290 295 300

<210> 54
<211> 1545
<212> DNA
<213> *Bacillus subtilis*

<400> 54
atgacaacac cttacaacaa cgagccattc acaaatttcc aagatcaaaa ctacgtggaa 60
gcgtttaaaa aagcgcttgc gacagtaagc gaatatattag gaaaaagacta tccgctttgtc 120
attaacggcg agagagtgga aacgggaagcg aaaaatcggtt caatcaaccc agctgataaaa 180
gaagaagtcg tcggcccgagt gtcaaaagcg tctcaagagc acgctgagca agcgattcaa 240
gcggctgcga aagcatttga agagtggaga tacacgtctc ctgaagagag agcgctgtgc 300
ctgttccgcg ctgctgcgaa agtccgcaga agaaaacatg aattctcagc ttgtctttgt 360
aaagaagcag gaaagccttg gaacgagggc gatgccgata cggctgaagc gattgaactc 420
atggagtatt atgcacgcca aatgatcgaa ctggcaaaa gcaaacccgt caacagccgt 480
gaagcgagaa aaaaccaata tgtatacacg ccgaactggag tgacagctgt tatcccgctt 540
tggaacttct tgtttgcgat catggcaggc acaacagtg cgccgatcgt tactggaaac 600
acagtggttc tgaaaacctgc gagtgtctaca cctgttattg cagcaaaaatt tgttgaggtg 660
cttgaagagt ccggatttgc aaaaggcgta gtcaactttg ttccgggaaag cggatcgcaa 720
gtagggcgcat atcttgttga ccataccgaaa acaagcctta tcacatttac gggatcaaga 780
gaagtttgta cgagaatttt cgaaacgcgc gcaaggttgc agccgggcca gcgacattta 840
aagcgtgtca tcgctgaat gggcggtaaa gatacgggtt ttgttgatga ggaatcgagc 900
attgaattag cggctcaatc gatctttact tcagcattcg gctttgcggg acaaaaatgc 960
ttcgcagggt cagctgcagt agttcatgaa aaagtgtatg atcaagtatt agagcgtgtc 1020
tttgaattta cggaatcaaa agtaaacagc aaacctgaca gtgcagatgt ttatgtggaa 1080
cctgtcaatt accaaggttc ttatgataaa attatgagat atattgagat cggaataacag 1140
gaagggcggt tagtaagcgt cgggtactgt gatgattcga aaggataact catcaaacct 1200
acgatcttgc ctgacottga tccgaaagca agactcatgc aggaagaaat ttccggaact 1260
gttctgtgcat ttgttaaaat gtcagacttt gatgaagctt tagaagtggc aaacaatact 1320
gaatatggtt tgacagggcg ggttatcaca aacaaccgca agcacatcga gcgtgcgaaa 1380
caggtaattcc atgtcggaaa cctatacttc aaccgcaact gtacagctgc tatcgtcggc 1440
taccatccgt ttggcggtt caaaatgtcg ggaacggatt caaaagcagg cgggcgggat 1500
tacttggtc tgcatatgca agcaaaaaa atcagtgaat tgttc 1545

<210> 55
 <211> 515
 <212> PRT
 <213> *Bacillus subtilis*

<400> 55
 Met Thr Thr Pro Tyr Lys His Glu Pro Phe Thr Asn Phe Gln Asp Gln
 1 5 10 15
 Asn Tyr Val Glu Ala Phe Lys Lys Ala Leu Ala Thr Val Ser Glu Tyr
 20 25 30
 Leu Gly Lys Asp Tyr Pro Leu Val Ile Asn Gly Glu Arg Val Glu Thr
 35 40 45
 Glu Ala Lys Ile Val Ser Ile Asn Pro Ala Asp Lys Glu Val Val
 50 55 60
 Gly Arg Val Ser Lys Ala Ser Gln Glu His Ala Glu Gln Ala Ile Gln
 65 70 75 80
 Ala Ala Ala Lys Ala Phe Glu Glu Trp Arg Tyr Thr Ser Pro Glu Glu
 85 90 95
 Arg Ala Ala Val Leu Phe Arg Ala Ala Lys Val Arg Arg Arg Lys
 100 105 110
 His Glu Phe Ser Ala Leu Leu Val Lys Glu Ala Gly Lys Pro Trp Asn
 115 120 125
 Glu Ala Asp Ala Asp Thr Ala Glu Ala Ile Asp Phe Met Glu Tyr Tyr
 130 135 140
 Ala Arg Gln Met Ile Glu Leu Ala Lys Gly Lys Pro Val Asn Ser Arg
 145 150 155 160
 Glu Gly Glu Lys Asn Gln Tyr Val Tyr Thr Pro Thr Gly Val Thr Val
 165 170 175
 Val Ile Pro Pro Trp Asn Phe Leu Phe Ala Ile Met Ala Gly Thr Thr
 180 185 190
 Val Ala Pro Ile Val Thr Gly Asn Thr Val Val Leu Lys Pro Ala Ser
 195 200 205
 Ala Thr Pro Val Ile Ala Ala Lys Phe Val Glu Val Leu Glu Glu Ser
 210 215 220
 Gly Leu Pro Lys Gly Val Val Asn Phe Val Pro Gly Ser Gly Ser Glu
 225 230 235 240
 Val Gly Asp Tyr Leu Val Asp His Pro Lys Thr Ser Leu Ile Thr Phe
 245 250 255
 Thr Gly Ser Arg Glu Val Gly Thr Arg Ile Phe Glu Arg Ala Ala Lys
 260 265 270
 Val Gln Pro Gly Gln Gln His Leu Lys Arg Val Ile Ala Glu Met Gly
 275 280 285
 Gly Lys Asp Thr Val Val Val Asp Glu Asp Ala Asp Ile Glu Leu Ala
 290 295 300
 Ala Gln Ser Ile Phe Thr Ser Ala Phe Gly Phe Ala Gly Gln Lys Cys
 305 310 315 320
 Ser Ala Gly Ser Arg Ala Val Val His Glu Lys Val Tyr Asp Gln Val
 325 330 335
 Leu Glu Arg Val Ile Glu Ile Thr Glu Ser Lys Val Thr Ala Lys Pro
 340 345 350
 Asp Ser Ala Asp Val Tyr Met Gly Pro Val Ile Asp Gln Gly Ser Tyr
 355 360 365
 Asp Lys Ile Met Ser Tyr Ile Glu Ile Gly Lys Gln Glu Gly Arg Leu
 370 375 380
 Val Ser Gly Gly Thr Gly Asp Asp Ser Lys Gly Tyr Phe Ile Lys Pro
 385 390 395 400

Thr Ile Phe Ala Asp Leu Asp Pro Lys Ala Arg Leu Met Gln Glu Glu
 405 410 415
 Ile Phe Gly Pro Val Val Ala Phe Cys Lys Val Ser Asp Phe Asp Glu
 420 425 430
 Ala Leu Glu Val Ala Asn Asn Thr Glu Tyr Gly Leu Thr Gly Ala Val
 435 440 445
 Ile Thr Asn Asn Arg Lys His Ile Glu Arg Ala Lys Gln Glu Phe His
 450 455 460
 Val Gly Asn Leu Tyr Phe Asn Arg Asn Cys Thr Gly Ala Ile Val Gly
 465 470 475 480
 Tyr His Pro Phe Gly Phe Lys Met Ser Gly Thr Asp Ser Lys Ala
 485 490 495
 Gly Gly Pro Asp Tyr Leu Ala Leu His Met Gln Ala Lys Thr Ile Ser
 500 505 510
 Glu Met Phe
 515

<210> 56
 <211> 762
 <212> DNA
 <213> *Bacillus subtilis*

<400> 56
 atgcaatcct tgaattatga agatcagggtg ctttggacgc gctggaaga gtggaagat 60
 cctaaagccg gtgacgactt aatgcgcctg tacatgccgc ttgtcacata tcatgtaggc 120
 agaattttctg tcggactgcc gaaatcagtg cataaagacg atcttatgag ccttggtatg 180
 ctctggtttat atgatgccct tgaataaattt gaccocagcc gggactataa atttgatacc 240
 taccctctcgt ttagaattcg cggcgcaatc atagacgggc ttctgtaaga agattggctg 300
 cccagaacct cgcgcgaaaa aacaaaaaag gttgaagcag caattgaaaa gcttgaacag 360
 cggtatcttc ggaatgtatc gcccgcgga aattgcagag aactcggaat gacggtacag 420
 gatgtcgtgt caacaatgaa tgaaggtttt ttgcaaatc tgctgtcaat tgatgaaaag 480
 ctccatgatc aagatgcagg ggaataacatt caagtcattg tcagagatga caaaaatgtt 540
 ccgcctgaag aaaagattat gaaggatgaa ctgattgcac agcttgcgga aaaaattcac 600
 gaactctctg aaaaagaaca gctggtttgc agtttgttct acaaaagagg gttgacactg 660
 acagaaatcg gacaagtatt aaattctttct acgtcccgc caattcagat ccattcaaa 720
 gcattattta aattaaagaa tctgctggaa aaagtgtac aa 762

<210> 57
 <211> 254
 <212> PRT
 <213> *Bacillus subtilis*

<400> 57
 Met Gln Ser Leu Asn Tyr Glu Asp Gln Val Leu Trp Thr Arg Trp Lys
 1 5 10 15
 Glu Trp Lys Asp Pro Lys Ala Gly Asp Asp Leu Met Arg Arg Tyr Met
 20 25 30
 Pro Leu Val Thr Tyr His Val Gly Arg Ile Ser Val Gly Leu Pro Lys
 35 40 45
 Ser Val His Lys Asp Asp Leu Met Ser Leu Gly Met Leu Gly Leu Tyr
 50 55 60
 Asp Ala Leu Glu Lys Phe Asp Pro Ser Arg Asp Leu Lys Phe Asp Thr
 65 70 75 80
 Tyr Ala Ser Phe Arg Ile Arg Gly Ala Ile Ile Asp Gly Leu Arg Lys
 85 90 95
 Glu Asp Trp Leu Pro Arg Thr Ser Arg Glu Lys Thr Lys Lys Val Glu
 100 105 110

Ala Ala Ile Glu Lys Leu Glu Gln Arg Tyr Leu Arg Asn Val Ser Pro
 115 120 125
 Ala Glu Ile Ala Glu Glu Leu Gly Met Thr Val Gln Asp Val Val Ser
 130 135 140
 Thr Met Asn Glu Gly Phe Phe Ala Asn Leu Leu Ser Ile Asp Glu Lys
 145 150 155 160
 Leu His Asp Gln Asp Asp Gly Glu Asn Ile Gln Val Met Ile Arg Asp
 165 170 175
 Asp Lys Asn Val Pro Pro Glu Glu Lys Ile Met Lys Asp Glu Leu Ile
 180 185 190
 Ala Gln Leu Ala Glu Lys Ile His Glu Leu Ser Glu Lys Glu Gln Leu
 195 200 205
 Val Val Ser Leu Phe Tyr Lys Glu Glu Leu Thr Leu Thr Glu Ile Gly
 210 215 220
 Gln Val Leu Asn Leu Ser Thr Ser Arg Ile Ser Gln Ile His Ser Lys
 225 230 235 240
 Ala Leu Phe Lys Leu Lys Asn Leu Leu Glu Lys Val Ile Gln
 245 250

<210> 58
 <211> 602
 <212> DNA
 <213> *Bacillus licheniformis*

<400> 58
 atgaattttc aaacaatcga gcttgacaca tggtagagaa aatcttattt tgaccattac 60
 atgaaggaag cgaatgttgc tttcagcacc acggcaaacg tcaatgtgac aaatttgctc 120
 gcggtgctca agaaaaagaa gctcaagctg tatccggctt ttattttatat cgtatcaagg 180
 gtcattcatt cgcgcccctga gtttagaaca acggttgatg acaaaaggaag ctgggttatt 240
 gggaaacaaat gcacccggtgc tatgcgattt ttcacagga cgaccaaacg ttttcgcccc 300
 tctggacgga atactcagac gatttttgcg agttttatca tcaatatctt ctggagccgg 360
 agcgctttgg agacaaaagg ggcctttggg ctaagccgga catcccgccc aatacgtttt 420
 cagtttttcc tattccatgg gtgcgctttt caacattcaa tttaaacctt gataacagcg 480
 aacacttgct gccgattatt acaaacggga aatacttttc agaaggcagg gaaacatttt 540
 tgcccgtttc ctgcaagttc accatgcagt gtgtgacggc tatcatgccg gcgcttttat 600
 aa 602

<210> 59
 <211> 200
 <212> PRT
 <213> *Bacillus licheniformis*

<400> 59
 Met Asn Phe Gln Thr Ile Glu Leu Asp Thr Trp Tyr Arg Lys Ser Tyr
 1 5 10 15
 Phe Asp His Tyr Met Lys Glu Ala Lys Cys Ser Phe Ser Ile Thr Ala
 20 25 30
 Asn Val Asn Val Thr Asn Leu Leu Ala Val Leu Lys Lys Lys Lys Leu
 35 40 45
 Lys Leu Tyr Pro Ala Phe Ile Tyr Ile Val Ser Arg Val Ile His Ser
 50 55 60
 Arg Pro Glu Phe Arg Thr Thr Phe Asp Asp Lys Gly Gln Leu Gly Tyr
 65 70 75 80
 Trp Glu Gln Met His Pro Cys Tyr Ala Ile Phe His Gln Asp Asp Gln
 85 90 95
 Thr Phe Ser Ala Leu Trp Thr Glu Tyr Ser Asp Asp Phe Ser Gln Phe
 100 105 110

Tyr His Gln Tyr Leu Leu Asp Ala Glu Arg Phe Gly Asp Lys Arg Gly
 115 120 125
 Leu Trp Ala Lys Pro Asp Ile Pro Pro Asn Thr Phe Ser Val Ser Ser
 130 135 140
 Ile Pro Trp Val Arg Phe Ser Thr Phe Asn Leu Asn Leu Asp Asn Ser
 145 150 155 160
 Glu His Leu Leu Pro Ile Ile Thr Asn Gly Lys Tyr Phe Ser Glu Gly
 165 170 175
 Arg Glu Thr Phe Leu Pro Val Ser Cys Lys Phe Thr Met Gln Cys Val
 180 185 190
 Thr Ala Ile Met Pro Ala Leu Leu
 195 200

<210> 60
 <211> 39
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

<400> 60
 ctacattcta gacgatttgt ttgatcgata tgtggaagc 39

<210> 61
 <211> 37
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

<400> 61
 ggctgaggat ccatttcctca gccccagaaga gaacctc 37

<210> 62
 <211> 38
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

<400> 62
 tccctcggat ccgaaatagg ttctgcttat tgtattcg 38

<210> 63
 <211> 38
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

<400> 63
 agcgttgagc tcgcgccatg ccattatatt ggctgctg 38

<210> 64
 <211> 38
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 64
 gtgacggaat tccacgtgcg tcttatattg ctgagctt 38

 <210> 65
 <211> 38
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 65
 cgttttggat ccaaaaacac cccttagat aatcttat 38

 <210> 66
 <211> 40
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 66
 atcaaaggat ccgctatgct ccaaatgtac acctttccgt 40

 <210> 67
 <211> 39
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 67
 atattttctgc aggctgatat aaataatact gtgtgttcc 39

 <210> 68
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 68
 catcttgaat tcaaagggta caagcacaga gacagag 37

 <210> 69
 <211> 37

<212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 69
 tgactttggat ccggttaagtg ggcagtttgt gggcagt 37

 <210> 70
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 70
 tagataggat cctattgaaa actgtttaag aagagga 37

 <210> 71
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 71
 ctgattctgc aggagtgttt ttgaaggaag cttcatt 37

 <210> 72
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 72
 ctccgcggta ccgtcacgaa tgcgcctctt attctat 37

 <210> 73
 <211> 38
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 73
 tcgctgggat ccttgccgcc gtggaatcga tttgtcc 38

 <210> 74
 <211> 37
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> primer

 <400> 74
 gcaatgggat cctatatcaa cggttatgaa ttcacaa 37

 <210> 75
 <211> 37
 <212> DNA
 <213> Artificial Sequence

 <220>
 <223> primer

 <400> 75
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 <210> 76
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